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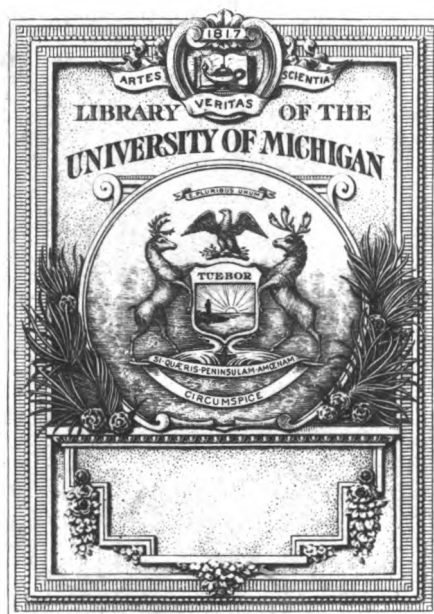
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BAY OF BENGAL PILOT.
1887.



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THE
BAY OF BENGAL PILOT,

INCLUDING
SOUTH-WEST COAST OF CEYLON,
NORTH COAST OF SUMATRA,
NICOBAR, AND ANDAMAN ISLANDS.

COMPILED FROM VARIOUS AUTHORITIES.

PUBLISHED BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

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The Bay of Bengal Pilot contains Sailing Directions for the bay of Bengal and the adjacent coasts of Hindustán, Burma and Siam, together with Ceylon, the Nicobar, and Andaman islands, and the north coast of Sumatra; commencing at Colombo on the west, and ending, on the east, at Junkseylon.

The information has been chiefly derived from the following surveys:—

In Ceylon, the southern coast by Mr. T. H. Twynam, Master Attendant at Galle, 1833, and by Captain W. J. S. Pullen, R.N., and Staff Commander G. F. MacDougal, R.N., H.M.S. *Cyclops*, 1860; the northern coast, Palk bay and strait, by Lieutenants F. T. Powell, and R. Ethersey, I.N., and Mr. J. J. Franklin, R.N., 1838–45.

In Hindustán, the Coromandel coast by Lieutenant M. A. Sweny, I.N., 1859–60, and Commander W. Fell, I.N., 1848; the northern part of the bay of Bengal chiefly by Captain R. Lloyd, I.N., 1833–40, Commander C. Y. Ward, I.N., 1851–59, and Lieutenant J. A. Heathcote, I.N., 1855–62.

The Nicobar islands, by the Officers of the Danish Corvette *Galathea*, 1846, and of the Imperial Austrian frigate *Novara*, 1858; parts of the Andaman islands by Lieutenant Archibald Blair, 1788–95.

The Burma, Pegu, and Martaban coasts, by Lieutenant R. Moresby, I.N., 1824, Captain J. Crawford (Bombay Marine), 1826, Captain D. Ross, I.N., 1829–33, Captain Laws and Commander Halstead, R.N., 1830.

Mergui archipelago and coast of Tenasserim, the outer portion by Captain D. Ross and Commander R. Lloyd, I.N., 1827–30; the inner portion, by the latter officer assisted by Lieutenants A. Young and W. Fell, I.N., 1838.

Surveys of various portions, by the Officers of the Marine Survey of India, 1874 to 1886.

The following publications have been consulted, and in some instances quoted.

Voyage of the *Novara*, Vol. 2, 1862; Becher's Navigation of Indian ocean, 1863; Horsburgh's Directory, Vol. 1., 8th edition, 1864; Taylor's Sailing Directory, Part I., 1874; Wall's Guide to the river Húgli, 3rd edition, 1874; Heckford's Sailing Directions for the bay of Bengal, 7th edition, 1876; Marshall's Hand-book of Directions for Ports in Madras and Ceylon, 2nd edition, 1878; Imperial Gazetteer of India, 1881; Elson's Sandheads Sailing Directory, 1881; Findlay's Sailing Directory for the Indian ocean, 4th edition, 1882; Imray's Bay of Bengal Pilot, 1884; Indian Government Meteorological Memoirs and Reports to 1885; Information connected with river Húgli, with the Indian Tide Tables, 1885; Journals of the Royal Geographical Society; the Nautical and Mercantile Magazines, also the Remark Books of H.M.'s Ships employed on the East India Station.

The work has been compiled by Commander L. S. Dawson, R.N., who has incorporated the latest information furnished by Commander A. D. Taylor (late I.N.), with recent remarks and additions from the Officers of the Marine Survey of India, 1874 to 1885. It has been prepared for the Press by Lieutenant W. S. White, R.N., of the Hydrographic Department of the Admiralty.

By the publication of this work, all Hydrographic Notices relating to the bay of Bengal series, as also all Notices to Mariners inclusive of No. 174 of 1886, are cancelled.

W. J. L. W.

Hydrographic Office, Admiralty, London,
February, 1887.

ORTHOGRAPHY.

As far as has been found possible,* the native names in this book are spelt in accordance with the following system, which will gradually be introduced into all Admiralty Sailing Directions. Where native names have been so long written in a form, which, though not in accordance with this system, has become familiar to English eyes from being so spelt in all charts and maps, they are retained, and no European names are changed from their correct orthography. Information as to the proper spelling of native names so as to produce the nearest approximation to the true sound, by this system, is invited, but it must be remembered that only an approximation is aimed at. The position of the accent denoting the syllable on which emphasis, or the "stress" should be laid, is very important, as the sound of so many words is utterly changed by its misplacement.

Letters.	Pronunciation and Remarks.	Examples.
a	<i>ah</i> , <i>a</i> as in <i>father</i> - - - - -	Java.
e	<i>eh</i> , <i>e</i> as in <i>benefit</i> - - - - -	Banána.
i	English <i>e</i> ; <i>i</i> as in <i>ravine</i> ; the sound of <i>ee</i> as in <i>beet</i> . Thus, not <i>Feejee</i> , but	Tel-el-Kebír. Medina.
o	<i>o</i> as in <i>mote</i> - - - - -	Fiji.
u	long <i>u</i> as in <i>flute</i> ; the sound of <i>oo</i> in <i>boot</i> . Thus, not <i>Zooloo</i> , but	Hindi. Tokio.
	All vowels are shortened in sound by doubling the following consonant.	Zulu.
		Sumatra.
		Yarra.
		Mecca.
		Jidda.
		Bonny.
		Budda.
	When <i>ch</i> follows a short vowel, <i>t</i> should be inserted -	Kutch.
	Vowels followed by <i>ng</i> are short - - -	Ning po.
		Tungching.
	Doubling of a vowel is only necessary where there is a distinct repetition of the single sound.	Kaaba.
		Oosima.

* The spelling of Indian names has been largely taken from Hunter's Imperial Gazetteer of India. The form of spelling for places on the Burma coast is, in most instances, in accordance with the system adopted in "Tables for the Transliteration of Burmese into English," published in Rangoon, 1884; this system appears very similar to that adopted by the Admiralty.

Letters.	Pronunciation and Remarks.	Examples.
ai	English <i>i</i> as in <i>ice</i> - - - - -	Shanghai.
au	<i>ow</i> as in <i>how</i> - - - thus, not <i>Foochow</i> , but	Fuchau.
ao	is slightly different from above - - - - -	Macao.
ei	as <i>ey</i> in English <i>they</i> - - - - -	Beirút.
b	English <i>b</i> .	
c	is always soft, but is so nearly the sound of <i>s</i> that it should be seldom used. If <i>Celebes</i> were not already recognised it would be written <i>Selebes</i> .	Celebes.
ch	is always soft as in <i>church</i> - - - - -	Chingchin.
d	English <i>d</i> .	
f	English <i>f</i> . It should always be put for <i>ph</i> . Thus, not <i>Haiphong</i> , but	Haifong.
g	is always hard. (Soft <i>g</i> is given by <i>j</i>) - - -	Galápagos.
h	is always pronounced when used.	
j	English <i>j</i> - - - - -	Japan.
k	English <i>k</i> . It should always be put for the hard <i>c</i> . Thus, not <i>Corea</i> , but	Jinchuen.
kh	The Arabic guttural - - - - -	Korea.
gh	is another guttural, as in the Turkish - - -	Khan.
l		Dagh.
m		Ghazi.
n		
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**IN THIS WORK THE BEARINGS ARE ALL MAGNETIC,
EXCEPT WHERE MARKED AS TRUE.**

**THE DISTANCES ARE EXPRESSED IN SEA MILES OF
60 TO A DEGREE OF LATITUDE.**

**A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO 100
FATHOMS.**

**THE SOUNDINGS ARE REDUCED TO LOW WATER OF
ORDINARY SPRING TIDES.**

* indicates that a plan is given upon the coast chart, which is shown by the diagram to embrace it.
 * 71° indicates that a plan of the place against which it is written is given upon chart N° 71°
 A number against the name of a place thus; Tarry R. 984, shows that a separate plan is published bearing that number.
 For details of scales, prices, &c. see Admiralty Catalogue.



For later information respecting the lights which are described in this work, seamen should consult the Admiralty List of Lights in South Africa, East Indies, China, &c. These lists are published early in the current year, corrected to the preceding 31st December.

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80°

85°

90°

95°

100°

THE BAY OF BENGAL PILOT.

GENERAL REMARKS.—DESCRIPTION.—RIVERS.—WINDS AND WEATHER. — BAROMETER. — TEMPERATURE. — CLIMATE AND RAINFALL.—VARIATION.—CYCLONES.—CURRENTS. — TIDES. — SURFACE TEMPERATURE. — SOUNDINGS. — REMARKS ON MAKING PASSAGES.

GENERAL REMARKS.—The bay of Bengal,* so called from the Indian province situated on its northern side, the name of which is derived from Banga,† the Sanskrit term for that part of the country, is a considerable gulf of the Indian ocean, triangular shaped, comprised between the parallels of 8° and 20° N. latitude, and the meridians of 80° and 98° E. longitude. It is bordered on the east by the coasts of Arakan, Pegu, Tenasserim, and part of the Malay peninsula, while on its western shore, southward of Bengal, stretch the Orissa and Coromandel coasts, the indentation known as Palk bay (so named from the Dutch governor who first navigated it), and the east coast of the island of Ceylon. Between Chittagong on the east, and Balasor on the west, at its head, the bay of Bengal is about 250 miles in breadth, whereas the distance across its mouth, from the Malay peninsula to cape Comorin, is about 1,200 miles; or, if measured between the south point of Ceylon and the north point of Sumatra, about 880 miles.

The Venetians were the first Europeans trading with India proper, before the discovery of the passage to it round the cape of Good Hope in 1497. The Portuguese then commenced their trading visits to India. In December 1600, the charter was granted, out of which originated the East India Company. The first English factory was erected in 1625 at

* See Admiralty charts :—Indian ocean, northern part, No. 7486; and bay of Bengal No. 70.

† The term “Banga” applies, strictly speaking, to the country stretching south-east from Bhagalpur to the sea.

Armeghon, about 66 miles north of Madras. In 1634 the English obtained the privilege of free resort to the port of Pippli in Bengal, formerly situated near the mouth of the Subarnarekha river. The first factory in Bengal was built at the village of Húgli, about 26 miles further up the river of that name than the Calcutta of to-day. In 1686, the site was removed to the present locality. From the time of building the first fort William,* 1696, the established presidencies in India were those of Madras, Bombay, and Bengal.

There are no first class harbours on the shores of the bay of Bengal, with the exception of Trincomali, a land-locked arm of the sea, situated on the east coast of Ceylon; but at Madras, on the Coromandel coast, engineering efforts have partly succeeded in enclosing by means of artificial breakwaters, a harbour to afford shelter from the continuous heavy surf, as well as the cyclonic storms which occasionally sweep over this, in common with other parts of the bay. The river ports, Calcutta on the Húgli, and Chittagong on the Karnafuli, in Bengal, are, however, much frequented; as also are those of Akyab, Bassein, and Rangoon; and in a lesser degree, Moulmein, situated some 80 miles eastward of Rangoon, on the Salween river.

Ceylon,† known as Lanka to the natives of India, but called Serendib by the Arabs, is situated off the south-east extremity of the peninsula of Hindustán.

This island was taken by the British in 1796, but the whole of the interior did not acknowledge British rule until about the year 1815, when it became a Crown colony. The extreme length of Ceylon, north and south, is 240 miles, and its greatest breadth, on the parallel of Colombo, is half of its length. The northern part of the island is low and flat, but the southern is mostly mountain region, separated from the nearest or Western Gháts of India by a gap of 200 miles. The great elevation and isolated position of Ceylon, by arresting the winds from all points of the compass, causes a considerable amount of rain to fall at different parts of the island throughout the year. The population is about two millions, of whom about 5,000 are whites.

In Burma, the province of Arakan, extending from lat. 20° 46' N. to about lat. 16° N. was ceded to the British in 1826, and at the same time the Tenasserim provinces (a narrow strip on the east side of the bay of Bengal about 450 miles in length) comprising Martaban, Ye, Tavoy, and Mergui, became British territory. The Pegu province, situated inter-

* The present fort William of Calcutta was commenced by Lord Clive in 1757.

† The Portuguese speak of Ceylon as Celan. To the Greeks and Romans it was known as Taprobane.

mediately between those of Arakan and Tenasserim, was annexed in the year 1853.*

Upper Burma, the remaining portion of the Burmese Kingdom, bounded on the North by Assam and Thibet, and on the east by China and the Shan States, was added to the British dominions in 1886.

The Nicobar group, called by the Malays the Sambilangs or Nine islands, consist of nine large and several smaller islands. From 1756 to 1848 these islands were considered to belong to the Danes, but owing to the representation of their unhealthiness by the Danish Admiral, Steen Bille, who visited them in the *Galathea*, they were abandoned in the latter year. In 1869, the Indian Government took possession, forming a penal colony at Nankauri harbour, about the centre of the group, subordinate to that at port Blair of the Andaman islands.†

The Andaman islands were taken possession of by the East India Company in 1789, Lieutenant Archibald Blair making a survey of parts of the group. A small penal colony about the same time was established on their south-east side. In 1795, this was removed to a harbour in the north-east part of North Andaman island, which was termed port Cornwallis. The new site proved unhealthy and was abandoned in 1796. In 1858, a penal settlement was formed at the original position on the South Andaman island, to which the name of port Blair was again given and still continues.

DESCRIPTION.—Ceylon.—The west coast of Ceylon is low near the sea, and much planted with trees. Inland, the mountains attain a great elevation. Between the coast from Galle to Colombo and Adam's peak there is much elevated country. North of Colombo, the country becomes lower towards the north end of the island. The south and east shores of Ceylon are bold, rocky, and in many parts picturesque, especially towards the south, where the mountains of the interior approach the coast, and a gentle declivity extends from their base to the sea, terminating in a level beach fringed with groves of cocoa-nut trees. The north and north-east shores are flat, and indented with lagoons and inlets from the sea. The principal harbours are Colombo on the west, Trincomali on the north-east, Point de Galle on the south. The interior of the island of Ceylon abounds in lofty mountains covered with forest, but these do not approach nearer the coast than 30 or 40 miles except on the south where there is a low range. The north-east part of the island is particularly low and bare.

* The population of that portion of Burma, then under British Dominion, increased from 2,747,148 in 1872 to 3,736,771 in 1882, and the public revenue from 1,565,186*l.* in 1874 to 2,702,086*l.* in 1883, the total value of exports and imports during the latter year were 10,812,412*l.*

† For early history of Nicobar islands, see voyage of *Novara*, vol. 2, p. 1.

HINDUSTÁN.—The district of Tinneveli lies at the south-east extremity of Hindustan, it has no ports of consequence and in some parts, the tide rises only two or three feet. Between Ceylon and point Ramen, in Madura, is the low and sandy island of Rameswaram. The strait between it and the mainland is about a mile wide, but obstructed by rocks having a narrow navigable channel for small vessels, known as the Pámbam (Paumben) pass. About 30 miles northward of the Pámbam pass, the Tanjore coast commences, and, after bordering the north-west side of Palk bay, to point Calimere, the northern point of entrance to Palk strait, trends to the northward as far as Coleroon river, in lat. $11^{\circ} 24' N$. The Tanjore coast is low and flat, the first objects seen in approaching it being the tops of the trees.

Pondicherri on the Coromandel coast, the head quarters of the French in India, has a roadstead where anchorage may be obtained, and landing may occasionally be accomplished in ships' boats, but in this respect it is inferior to Porto Novo 16 miles to the southward. Madras, in lat. $13^{\circ} 5' N$., lies on a coast, where the current is rapid, and a heavy surf prevails. An artificial harbour formed by breakwaters and nearly completed, is available for shipping. The river Kistna flows into the sea in about lat. $15^{\circ} 55' N$. at point Divi. From the mouth of the Kistna to that of the Ganges the east coast of Hindustán, forming the north-west shore of the bay of Bengal, trends nearly straight N.E. and S.W., and an irregular mountain barrier, named the eastern Gháts, extends southwards at varying distances from the coast, which is here, for the most part, sandy and barren. The elevated country within this mountain-barrier is called Balaghát, or the "country above the gates," in contra-distinction to Payanghát or "country below the gates."

Extensive plains spread themselves between the Coromandel coast and the outlying ridges or elevated country of the Eastern Gháts. The Nilgiri mountains extend from about $76^{\circ} 30' E$. to $77^{\circ} E$. longitude, near the parallel of $11^{\circ} N$., with a breadth of about 15 miles. They attain an elevation of about 8,640 feet above the sea and present numerous peaks exceeding 5,000 feet in altitude. To the south of the Nilgiri mountains, a valley known as the Palghát valley, with a breadth of about 20 miles, stretches from sea to sea, through which the railway connecting Bepur and Madras passes. To the south of the Palghát valley, a mountain chain stretches to cape Comorin, separating the districts of Cochin and Travancore on the west, from those of Tanjore, Madura, and Tinneveli on the east. On the sea coast after passing Masulipatam on a northern branch of the Kistna river, and other places of less importance, Coringa bay in lat. $16^{\circ} 49' N$. is arrived at. Into Coringa bay, one of the branches of the Godávári river falls; but a bar of mud obstructs its entrance. A little north of Coringa bay, the low coast terminates, and a ridge of mountains

commences, and approaches the coast near the small ports of Vizagapatam and Kalingapatam, to as far as Ganjá, in lat. $19^{\circ} 23' N$. Proceeding north from Ganjá, past the mouth of the Chilka lake, Purí, the various sand-barred mouths of the Mahanadi, and False point and bay, there is no special feature till point Palmyras, at the entrance of the Dhamra river, is reached. Balasor roads, or bay extend northward of the Dhamra river entrance. The town of Balasor is situated some 19 miles up the Burabalang river, the entrance to which is shallow.

The coast of Bengal was formerly considered to commence at the once prosperous town of Pippli, (no longer existing) on the Subarnarekha river, about 22 miles north-east of Balasor, but Pippli sand now effectually blocks the shallow entrance, and the trade has long since passed away. Southward from the entrance of the Húgli, or west branch of the Ganges, several banks extend, which render navigation difficult. The whole coast from the west, to the east mouth of the Ganges, consists of low islands, with finger-like under water continuations extending to the southward, divided from one another by branches of the river, and intersected by creeks.

Chittagong, lying at the south-east extremity of the province of Bengal, in the north-east corner of the bay of Bengal, is divided from Bengal proper by the east mouth of the Ganges, known as the Meghna river; and from Arakan by the Naaf river, and has a coast line of about 100 miles. The northern part of this coast is low, and generally bordered by sand and mud flats, but the southern portion is steep and cliffy.

THE COAST OF BURMA forming the east side of the bay of Bengal stretches from the Naaf river to that of Pakchan, a distance of about 900 miles, and includes the sea shores of the provinces of Arakan, Pegu, and Tenasserim.

Arakan, extending from the Naaf river to cape Negrais, a distance of about 320 miles, is bold, rocky, and generally mountainous. The harbours of Akyab, Kyaukpyu, and Ramree, indent its shores, which are much cut up by backwaters and islands, to as far south as the parallel of $18^{\circ} 40' N$. Southward of this, the coast becomes steep and rocky, with scattered off-lying islets and rocks. The chief island off this part of the coast is Chedúba, separated from the main by a navigable strait for vessels of moderate draught. The lofty mountains, 2,000 to 8,000 feet in height, known to the Burmese as Yoma, which separate the province of Arakan from Upper Burma, extend in a southerly direction, and nearing the coast as they continue south, terminate at cape Negrais in a bold bluff, on the eastern side of which, and taking a northerly course, runs the Bassein river (the western mouth of the Irrawaddy).

The coast of Pegu, on which are the mouths of the Irrawaddy and Sittang rivers, extends westward for about 180 miles, from the latter (which separates it from that of Tenasserim) to the Bassein river. The capital, Rangoon, as well as Bassein, is situated in Pegu. The waters of the north part of the gulf of Martaban wash the greater part of the Pegu coast, which is low, shallow in approach, and muddy.

The Tenasserim provinces, comprising Moulmein (Amherst), Tavoy, Ye, and Mergui, extend in a north and south direction for about 450 miles, and are bounded on the north by the Sittang river, and on the south by that of Pakchan. Except in the extreme north, the Tenasserim coast line may be described as elevated, rocky, wooded, and bordered throughout almost its entire extent by islands. These are very numerous towards its southern limit, known as the Mergui archipelago. High ranges of mountains form the background of the Tenasserim coast. These are for the most part intersected by numerous rivers and streams, which discharge a great quantity of water into the sea.

Between the Pakchan river and Salang or Junkseylon island, for a distance of 130 miles, the coast maintains its elevated wooded aspect, and is intersected by many creeks and rivers. The off-lying islands however become scarcer than to the northward of the Pakchan river.

The Andaman islands in the eastern part of the bay, consist of two large and several smaller islands. They form the larger and more northerly portion of the island chain which appears to continue the range of hills between cape Negrais and the north-west point of Sumatra. The Great Andaman island, about 150 miles in length, north and south, is cut into three parts, by Stuarts sound, and Andaman strait.

The Nicobar group, of which there are nine large and several smaller islands, are almost equi-distant between the Andaman islands and Sumatra, and are scattered in a north-trending chain between the parallels of $6^{\circ} 40'$ and $9^{\circ} 30' N.$ Most of these islands are hilly, and some of the mountains of considerable elevation, but there is also a great deal of swampy ground, causing them to be considered unhealthy. The strait dividing Great Nicobar island (the southern of the group) from the north coast of Sumatra is about 90 miles in width and about 760 fathoms deep in the central part.

Sumatra.—The north-west extremity of this island, a high bluff promontory, known as Achi head in lat. $5^{\circ} 34' N.$, and long. $95^{\circ} 15' E.$, forms the south-eastern limit of the bay of Bengal.

RIVERS.—The two most important rivers in India, the Ganges and Brahmaputra, disembogue in the northern part of the bay of Bengal, while the many-mouthed Irrawaddy finds exit on the eastern side of the bay.

The Ganges and Brahmaputra rivers.—The effluents of these rivers present a singular interlacement, in the numerous watercourses which have been formed in the alluvial flat by the rush of the swollen waters during the rains, uniting the water system of Bengal by a series of natural canals, nearly all of which are navigable by large boats, in the rainy season. That part of the delta through which the Ganges expands its branches, is a low district forming the northern shore of the bay of Bengal, called the “Sundarbans” or “Woods,” and is equal in extent to any of the three Kingdoms of which Great Britain is composed. It is a labyrinth of low islands, and creeks, bordered by jungle, and infested by wild animals. Attempts have been made, with passing success, to cultivate parts of this inhospitable tract. The district yields, however, salt and timber.

The Irrawaddy* which falls by fourteen mouths on the east side of the bay of Bengal, eastward of cape Negrais, into the gulf of Martaban, in about lat. 16° N., has also for its delta a vast alluvial plain, and is to Burma what the Ganges is to Bengal, viz., a source of abundance and the great commercial highway of the country. Of the Irrawaddy mouths, the Rangoon river on the east, and the Bassein river on the west, are considered the principal, and are most frequented.

Of the rivers of secondary importance which empty themselves into the bay of Bengal, may be named the Coleroon, Palar, Pennair, Kistna, Godáviri, Mahanadi, Dhamra and Húgli on the west side; and those of Chittagong, Arakan, Sittang, Salween, Tavoy, and Pakchan on the east.

WINDS AND WEATHER.†—The seasons, in the bay of Bengal, are commonly distinguished by the terms hot, cold, and rainy, but these distinctions apply more to the north part of the bay than to the south. The hot season continues from the beginning of March to the end of May, during which period the thermometer often exceeds 90° in the shade. The rainy season, generally simultaneous with the south-west monsoon, commences in June and lasts till October. During the first two months the rain is heavy and constant, but during the last two months of this season, there are frequent intermissions of rain, the weather is then close and sultry, and thick fogs not uncommon. The cold or fine weather season, continues from November to February, during which period, northerly winds prevail, the sky is generally clear and unclouded, and the dew at night abundant and penetrating.

The south-west monsoon is lighter in the southern than in the northern part of the bay of Bengal. Between Ceylon and the entrance to Malacca

* This spelling is retained by the Government of Burma.

† See Wind and Current charts for the Pacific, Atlantic, and Indian oceans, published by the Admiralty, 1872.

strait, from the equator to the latitude of 8° or 10° N., westerly winds are frequently experienced in October and November, which blow with strength and regularity for several days at a time. In a line from Ceylon to Achi head of Sumatra, their direction is from W.S.W. to W.N.W., and more to the northward in the bay from S.W. and S.S.W. These westerly winds are most prevalent about the Nicobar islands and entrance to Malacca strait. The north-east monsoon is generally expected late in October, and considered to end in March.

In Ceylon, from May to September, the south-west monsoon prevails, but no rain falls on the south-east side of the island ; while the west coast is deluged, the east coast is sometimes exhausted with dryness. October brings regular land and sea breezes, when rain falls inland amongst the hills, but none near the Basses lighthouses. In November the north-east monsoon arrives with thunder, lightning, and much rain, affecting the north part of the island, but scarcely felt on the south. During December and January a strong north-east monsoon prevails along the east coast and rain falls on both sides of the island, though less on the west coast than in the south-west monsoon. In February and March land and sea breezes occur. April is stormy, especially towards the end of the month, as also is the beginning of May, when a cyclone is occasionally experienced on the Madras coast.*

Currents and Winds.—For statement of currents and winds experienced on the coast of Ceylon during the years 1881–6, *see* Appendix, p. 378.

On the Coromandel coast, or south-west shore of the bay, the south-west monsoon commences to blow in the latter end of March or beginning of April, but does not attain its full strength and regularity till June. Land and sea breezes being not uncommon in March, April, and May. Even during the months of June, July, and August, a land breeze, no doubt the prolongation of the south-west monsoon, blowing on the west coast of Hindustán, sometimes blows from the shore, for from twenty-four to forty-eight hours. In September the south-west monsoon declines, and the north-east monsoon may be looked for about the middle of October, from which time until the beginning of December navigation may be considered dangerous owing to expected cyclones. During the months of December, January, and February the weather is generally settled and calm, and land and sea breezes regular.

In the north-west part of the bay, or in the neighbourhood of False bay and the approaches to the Húgli, the south-west monsoon is preceded by southerly and south-west winds which generally commence late in February, or early in March ; but not so early on the north-east side of the bay. Along the sea face of the Sundarbans and head of the bay,

* For winds and weather at Colombo, west coast of Ceylon, *see* page 35.

from December to March, there, are frequent light airs and calms, with smooth sea. These may happen either by day or night, but the breeze generally fails with the setting sun, and the first part of the night is calm. About midnight a breeze often commences at the S.E., or south, veering to west and north-west in the morning, and continuing this circular course freshens with the rising sun about 8 or 9 a.m. Late in March, or early in April, the southerly winds begin to set in regular and strong, with cloudy weather, and sometimes rain; but the stormy weather occurs towards the end of May, and continues until September. June and July are the months of the worst weather; towards the middle of August there is sometimes a break. In September, as the south-west monsoon declines, the weather becomes cloudy, with little rain. Late in September or early in October, the southerly winds fail, and are followed by variable breezes. Sometimes a storm is experienced all over the bay of Bengal in September or October, previous to the setting in of the north-east monsoon.

In the north-east part of the bay, near the Chittagong coast, the prevailing winds from March to May are from south-west, sometimes blowing fresh in the upper central part of the bay, after April, while near the shore, land and sea breezes are met with, moderate in the forenoon, but in the afternoon, freshening up and veering to the south-west quarter. In June and July it blows hard from S.S.E. to S.W. with rain, with now and then a cessation, during which fine weather may occur. During August and September the wind is more from the south-eastward, as the east side of the bay is closed with. From October to March, generally north-easterly, with fine and settled weather, veering more to the eastward in the latter month, with occasional heavy north-westers in the afternoon.

Burma.--On the more humid Burma coast, in the vicinity of cape Negrais and the entrance to the gulf of Martaban, there is but little cold season; the seasons here consist of the wet and the dry, and are more regular, extremes of heat and cold being less marked. Here about the middle of May, the south-west monsoon is said to fairly set in, and continue with torrents of rain until the middle of September. In December the north-east winds prevail, which veer to the eastward and blow fresh during the day. In January the wind is more to the northward. In February and March land and sea breezes prevail; and the weather, especially in the mornings, is foggy.

Near Achi head in the south-east part of the bay of Bengal, the south-west monsoon commences in the latter part of April, or early part of May, and ceases in October; but in November westerly winds frequently prevail; during this season, the weather is generally cloudy and stormy, accompanied with rain, especially in July and August when the monsoon is at its height. The north-east monsoon prevails here from November to April, which is the fair season, the weather being then more settled.

Nicobar islands.—The south-west monsoon or wet season extends from April to October, and the dry season or north-east monsoon, from November to March, but here the monsoon seasons are not so sharply defined as on the adjoining coast of the mainland.

Andaman islands.—The rainy season is said to commence about the 10th of May. In June the rains become heavier and thunder storms frequent, the squalls often sudden and severe, with dark cloudy weather. In July, the heavy rains sometimes abate their strength, and a few days break may be looked for. The rains continue however with more or less intensity until September is well advanced. January to May comprises the fine or dry season of this group.

Tenasserim coast.—Here the south-west monsoon commences about June, lasting till October. In the neighbourhood of Moulmein it sets in with great violence and lasts later than to the southward. In Mergui on the contrary, it commences mildly, and though the rains are much heavier during the south-west monsoon months, showers are common throughout the year. Between the Andaman islands and Junkseylon, southerly winds with cloudy weather and rain, are sometimes experienced in December and January.

BAROMETER.—In the bay of Bengal, the normal reading of the barometer, near the sea surface, may be considered at different seasons as follows :—

January, February, March	-	-	-	30·00
April, May, June	-	-	-	29·80
July, August, September	-	-	-	29·80
October, November, December	-	-	-	29·93

The barometer stands highest in the months of December and January, and lowest in July. At Calcutta and Chittagong we have more detailed information, for which *see* pages 177, 205. It should be remembered that the barometer in these latitudes has four distinct oscillations in the course of the twenty four hours, which though slight are perfectly regular in settled weather. At 10h. a.m. and 10h. p.m. the mercury is at its highest, and at 4h. a.m. and 4h. p.m. the mercury is at its lowest. The difference between the heights at 10h. a.m. and 4h. p.m. or during the day is usually little more than one-tenth of an inch. Any irregularity in the rise and fall of the mercury outside this limit should therefore be regarded with suspicion. For instance, if the barometer did not rise between the hours of four in the morning and ten in the forenoon, or between four in the afternoon and ten in the evening, the instrument would indicate considerable atmospheric disturbance. As certifying the approach of bad weather or a cyclone, the barometer may be depended upon, especially if accompanied

with the usual premonitory symptoms of a heavy swell, or threatening appearance in the weather.

TEMPERATURE.—The coolest months in the bay of Bengal are those of December and January, and the warmest that of May, although from April to October inclusive the temperature varies but little, and is generally above 80° . In the month of January the isotherm or line of equal temperature of 80° takes an east and west direction from the lat. of Point de Galle across the bay to the entrance of Malacca strait. Northward of this line the temperature gradually decreases to 77° on the parallel of the Great Andaman island, and to 70° on about the parallel of 20° N. latitude, northward of which, at Calcutta and Chittagong, it may be found to average as low as 67° , for this is the coldest month of the year.

In April and May, however, the state of the case is reversed. The warmest air at this season is to the north and west in the bay, the 86° isotherm then extends in a curve parallel to and inland of the Coromandel coast, stretching across on about the parallel of 20° N. latitude to the Arakan coast; northward of this the average temperature varies from 84° to 86° , but to the southward, the temperature falls all over the bay to a general average of from 82° to 84° . In July, when the south-west monsoon is at its height, the average temperature throughout the bay is about 82° , and the air is then laden with moisture. In October, the month of variables and calms, the air, though generally muggy and oppressive, maintains an average general temperature in the central part of the bay of 82° , on the Burma and Arakan coast of about 80° , and in the neighbourhood of Ceylon, or south west of the 82° belt, also of about 80° .

CLIMATE AND RAINFALL.—Ceylon.—The west coast of Ceylon has rain in every month, but two periods of maximum amount, one in May, when the sun passes the island in going northward, the other in October and November, coincident with the Madras monsoon. In the whole year the rainfall at Colombo is 72 inches.

The climate of the east coast of Ceylon differs materially from that of the south or west coast. The south-west monsoon which on the west coast is characterised by extreme moisture, on the east is experienced as a hot dry land wind, during the continuance of which, from April to September, there are only a few slight showers and the thermometer in the shade is sometimes as high as 95° , while the north-east monsoon, so slight on the west coast, prevails from October to March on the east, with heavy rains or occasional showers, the temperature varying from 76° to 84° . The extreme heat is never so great as on the Hindustán continent, but then the thermometer does not fall so low at the period corresponding to the Indian cold season, consequently the mean temperature throughout the year is

about the same. The north-east coast of Ceylon is the warmest, owing to the south-west monsoon becoming heated in its transit across the island. The mean annual rainfall on the east coast estimated at from 50 to 55 inches is about two-thirds that of the south-west.

The average maximum temperature at Trincomali is about 91° in the month of May. The greatest daily variation of the thermometer 17° , and the annual range from 74° to 91° ; whereas at Galle the annual range is from 71° to 87° , and the mean daily variation only 4° . On the south-west coast of Ceylon the annual fall of rain averages from 70 to 80 inches, and on the north-east coast from 50 to 55 inches.

The maximum rainfall in Ceylon, which on the south-west coast takes place in May, anticipates that of West Hindustán by more than a month. In July and August, when the south-west monsoon is at its height in the bay of Bengal, the rainfall of Ceylon is comparatively small, but in November there is another large downpour corresponding with that of the Coromandel coast. Thus does the Ceylon climate partake of the characteristics of the climates both of west and east Hindustán.

Coromandel coast.—Refreshing showers occasionally fall on this coast in July and August; but about the end of August and beginning of September, when the south-west monsoon slackens, the climate becomes close and sultry, and the wind variable until October, when the north-east monsoon commences. The annual fall of rain at Madras varies from 30 to 80 inches, but the usual quantity is about 50 inches. The general character of the climate is dry and hot, the range of the thermometer is from 70° or 75° to 84° or 88° , but in May and June it rises as high as 98° to 105° .

Bengal.—The hot season on the coast of Bengal, from March to the end of May, is very sultry, the thermometer rising to as much as 100° in the shade. Sudden gusts of north-west wind are sometimes experienced especially in April and May, which relieve and clear the atmosphere. The rainy season commences in June and lasts till October, and during the two first months the rain is so constant and heavy that three, four, and even five inches of water have been known to fall in a day, but during the two last months of this season there are frequent intermissions in the rain, the weather then becomes close and sultry and thick fogs prevail.

At Calcutta the greater proportion of rain that falls is brought by winds from between east and south-west, the direction of most rainfall being about S. by E.* The annual fall of rain on the coast of Bengal varies from 70 to 80 inches. During the cold season, from early in November to February, northerly winds prevail, the sky is generally unclouded and the weather pleasant. Dews are frequent at night, and in the more mountainous districts even frost is experienced.

* Blanford's Indian Meteorological Memoirs, Vol. I., p. 19.

Crossing the bay to Chittagong and the Arakan coast, exposed to the full force of the south-west monsoon, we there find the rainfall generally heavy, averaging about 105 inches. The atmosphere during the south-west monsoon is laden with moisture causing heavy dew at night and occasional dense fogs.

Burma.—The climate on the Burma coast resembles that of Bengal, but the seasons are less distinctly marked. Extremes of heat and cold are seldom experienced, and the seasons are regular. In Pegu there are only two seasons, the wet and the dry, and the thermometer ranges from 50° to 90°, but in the valley of the Irrawaddy three seasons are again marked, the cold, the hot, and the rainy. The rains here are heavy and continuous, and the rainfall probably as heavy as that of the Arakan coast. The following is a brief account of the rainy season as experienced at Rangoon, “The first sign of the south-west monsoon occurred April 10th, when a storm of considerable violence suddenly arose followed by torrents of rain. This was the beginning of what was called the “Mango-showers.” For four or five days much rain fell. It then cleared up and fine weather continued till the beginning of May. From then till the 20th, showers, squalls, thunder and lightning, and the monsoon had now fairly set in and lasted until about November 6th with breaks of a few days. As a rule the rain came down in heavy showers lasting 3 or 4 hours. Three or four hours of each day were generally comparatively fine. Squalls were frequent during the first half of the monsoon, but seldom exceeded a force of 8.”* (See Appendix, page 367.)

Sumatra.—The climate, especially in the north-west part, is said to be very wet; lofty ranges of hills intercept the rain bearing clouds of both monsoons, which, discharging their contents, cause a heavy rainfall, and render living in the plains particularly unhealthy to Europeans.

The Nicobar islands in consequence of their detached position have a climate, though tropical, not to be ranked amongst the hottest. The seasons here are not so sharply defined as in the same latitude on the main land. The rainy season is the predominant season of the year, even the driest months are not without rain. The annual rainfall has been estimated at from 100 to 150 inches.

South Andaman island, although the heat is here intense, it is not so much felt, as there is nearly always a sea breeze from one quarter or another. During the latter part of June the thermometer registered a mean height of 80·7° in the morning, 83·7° at midday, and 81·1° in the evening. In this month, thunderstorms were frequent at all hours of the day. “The rainy season commenced early in May, in the first half of July the heavy rains ceased, and several fine but cloudy days alternated with rainy ones.

* From the Remark Book of Captain R. H. M. Molyneux, R.N., *H.M.S. Ruby*, 1879.

This weather was reported to continue until the latter half of December, when the rains became lighter, though they occurred from time to time even in January and February. It was, however, stated that where clearing of the forest jungle had been effected, the commencement of the rains had been retarded for nearly half a month.”*

Tenasserim coast.—The chief characteristic of the climate on the Tenasserim coast is the length and severity of the wet season, the rains commence to fall in April, and continue with little cessation until October. During these months, the south-west wind coming direct from the sea is saturated with moisture. The seasons here are divided by the natives into the hot, rainy, and cold; the first commencing with the full moon in February, the second with the full moon in June, the third with the full moon in October. During the intervals between the monsoons, the winds are variable, and storms of thunder and lightning are prevalent. The cold season, during which the north-east wind blows across such an immense tract of land, is remarkable for its dryness. The temperature here varies from as low as 53° *minimum* in January, to 98° and 102° *maximum* in April and May, the range of temperature and monthly difference of *maximum* and *minimum* readings of the thermometer being in excess of those of Ceylon, or the coasts of the bay of Bengal generally. The annual rainfall on the Tenasserim coast has been estimated to reach as much as from 150 to 200 inches; the quantity varies, however, materially in different years.

The magnetic variation in the bay of Bengal is but slight. The 1° curve of equal magnetic variation may be said to pass along, and in the same direction with, the east coast of Ceylon, through point Calimere of south-east India, and takes a N.N.W. direction almost parallel to the west coast of India. From the east coast of Ceylon the variation increases towards the north-east part of the bay from 1° to 3° easterly, and is greatest on the Chittagong and Arakan coasts. It is increasing at the rate of about $1\frac{1}{2}$ minutes annually in the north-west part of the bay, 2 minutes in the north-east, but is nearly stationary in the south-east part.

CYCLONES.†—These storms in the bay of Bengal appear to be essentially a feature of the south-west monsoon, and may occur at any time when strong southerly winds enter from the Indian ocean, and extend over a considerable portion or the whole of the bay, or from the latter part of April to the middle of December. They appear to be most frequent during the months of August and September, and are then generally generated in the northern part of the bay, taking a westerly or north-

* Report of Mr. Kurz of the Royal Botanical Gardens, Calcutta, 1869.

† For further information see “Remarks on Revolving Storms,” published by the Hydrographic Department of the Admiralty, 3rd edition, 1883.

westerly direction across its head ; these storms are not, as a rule, so intense as those of May, and October and November. Cyclonic storms during the months of January, February, and March are of rare occurrence, and are probably due to very abnormal combinations of meteorological conditions.*

On the shores of the northern part of the bay of Bengal, important distinctions have been observed between the cyclones of October and November, and those which occur in April and May.

In October and November cyclones are usually generated in the eastern or central part of the bay of Bengal, and although the formation of the storm is preceded by many days of bad weather, and probably by a low barometer, there are usually no weather indications along the Bengal coast line, of the existence of the coming storm until a day or two before its arrival ; and it is not until the place is near the limit of the gale of wind which surrounds the body of the advancing cyclone that any decided fall in the barometer takes place. In the north-west part of the bay of Bengal during this season north-easterly winds predominate. The cyclones which are generated in October, somewhere between 14° N. and 18° N., are those which most frequently visit the Bengal shores, whilst the storms of November, which are generated further south, are (usually) only felt along the Madras coast.

The fall of the barometer indicating the approach of a cyclone in vessels situated north of the storms path, in October and November, is usually small, and there is no warning shift of wind if the vessel be to the north of the storm's path. To make use of this slight fall in the barometer, it should be remembered that the barometer in these latitudes has four diurnal oscillations, which are regular in settled weather. At 10h. a.m., and 10h. p.m., the mercury is highest. At 4h. a.m., and 4h. p.m., the mercury is lowest. The difference between the heights at 10 a.m. and 10 p.m. is generally one-tenth of an inch. If the barometer does not rise from 4 a.m. to 10 a.m., or from 4 p.m., to 10 p.m. the seaman should be on his guard, as in these latitudes the instrument would thus indicate considerable atmospheric disturbance.

In April the cyclones which occur in the bay of Bengal are usually generated in its southern part, and in May more to the northward. These storms, though violent, are not so much so as those of October, and seldom travel far inland. The barometer falls steadily four or five days previously ; south-west winds prevail during this season, and winds from the north-east are very unusual. But before a cyclone, and during its approach, north-easterly winds prevail over many degrees of longitude to the *north* of the storm, both on the eastern and western side of the path subsequently pursued,

* Indian Meteorological Memoirs, Vol. 2, part 4, 1885, contains useful information regarding cyclonic storms in the bay of Bengal.

and there seems to be no marked tendency of the wind to veer until the cyclone is close at hand. This fact, affecting as it does the general rule of allowing eight points to the right of the direction of the wind to determine the bearing of the centre, is important to remember; and a decided fall of the barometer should take place, before the centre is assumed to bear eight points to the right of the direction of the wind. At a considerable distance from the centre, and before the barometer has fallen much, the centre may bear as much as twelve points to the right of the direction of the wind. It will thus be apparent, for vessels situated to the northward of the storm's path, that in April and May, the fall of the barometer and shift of wind from south or S.W. to N.E., give timely warning of the approach of a cyclone.

Off the coast of Ceylon there sometimes occurs a violent but confined storm, though a true cyclone as to rotation, but which rather deserves the title of a tornado-cyclone, from its size. These may come from the middle of the bay of Bengal, and sometimes form very suddenly, and not far from the shore, towards which they travel. Batticaloa on the east coast of Ceylon has been more than once overtaken by one of these storms.*

The Madras cyclones usually commence at from N.N.E. to N.N.W., but it sometimes happens that the storm is ushered in with a north-east wind,, the wind veering to the eastward or westward, as the port may happen to be placed, in the right, or left hand semicircle of the storm. They generally travel from S.E. towards N.W., or from S.S.E. towards N.N.W., but occasionally they have been known to come in upon the coast from E.S.E., their rate of travelling being generally from 4 to 5 miles per hour. According to Piddington's law of storms the centre with the wind in this direction would bear N.E., or 8 points to the right hand, but local experience at Madras, shows that the more recent rule, to allow 10 and even 12 points at the commencement of the storm, is the correct one. On the Coromandel coast, from the middle of April to the middle of June, and from early in October to the end of December, may be considered the cyclonic periods.

The north-east shore of the bay of Bengal, from cape Negrais northward, appears particularly liable to cyclonic visitation, scarcely a year goes by without one or more of these storms being recorded. In November 1882, Kyaukpyu, a port at the north end of Ramree island, was devastated by a cyclone, and in the month of May 1884 the lighthouse situated on the Oyster reef was destroyed by a cyclone which raged for several hours in this neighbourhood, causing great damage to Akyab.

* January 7th 1805, H.M.S. *Sheerness* and two other vessels of war were driven on shore in a hurricane at Trincomali, the verge of which extended as far as Batticaloa.

The gulf of Martaban appears to be seldom visited by cyclones. The Andaman sea, however, comprised between the islands of that name and the east shore of the bay of Bengal, confined as it is, is said to be subject to cyclones of terrific violence, though they seem to be of rare occurrence.

INDICATIONS.—With that threatening aspect of the sky which generally precedes all storms,—such as the greasy halo round the sun or moon, the rolled and tufted forms of the clouds, with their lurid colours, and the heavy bank clinging to the horizon with its forks of lightning,—every seaman is acquainted. The best warning will, however, be found in the barometer, the language of which in the torrid zone, is unmistakeable, because there it is usually so undisturbed. The barometer falls as the centre is approached. When any such warning symptoms are observed no time should be lost in making preparation, and especially if to such appearances be added the confused sea which often precedes these revolving storms, and shows that they are at no great distance.

At the entrance of the river Húgli the earliest indications of a cyclone are afforded by the motions of the lower clouds, which drift rapidly in dark elongated masses from N.E. to S.W. These signs are never absent at the Húgli, when there is a cyclonic disturbance anywhere in the middle or northern parts of the bay of Bengal. The direction of the wind at the Sandheads before a cyclone is N.E. or E.N.E., more usually E.N.E., when the place is on the track of the storm. The squalls become more frequent, the driving rain gradually heavier, and a heavy swell comes up from the south-eastward. With such indications, even if the barometer shall have shown no considerable fall,* it may be concluded that

* The Miñnapur and Bardwan cyclone passed over the entrance of the Húgli 15th of October 1874.

From lat. 17° N. long. 90° E., where the existence of the storm first became known the centre pursued a N.N.W. course, more northerly as it approached the land, whence it curved gradually to the north-east, and finally broke up on the western ridge of the Garo hills in Assam. Its rate of movement in the bay of Bengal was not more than 6 or 7 miles an hour, which in passing the Sandheads increased to 10 or 11 miles.

This cyclone was remarkable for the comparatively high barometer in front of the storm as it advanced, but at the centre the mercury standing at 27.76 inches, was probably as low as in any recorded cyclone. The area of the body of the hurricane was small, about 50 miles in diameter; but outside the circumference, especially on its eastern side, a heavy gale of wind extended to some distance. The storm wave raised the level of the water, 16 feet at Diamond harbour, in the river Húgli. The pilot brigs stationed off the mouth of the Húgli misjudged the distance of the cyclone, and were probably misled by the slowness of the fall of the barometer, before they were actually within the radius.

The Chittagong cyclone of 31st October 1876, the storm wave from which submerged the island of Sandwip at the entrance of the Meghna river, appears to have been

the cyclone is not far distant, and it may be expected that the barometer will give less warning of the approach of a storm in October than in May or June.

To discover the position of the storm with respect to the vessel, or, in other words, to ascertain its bearing. In opposite hemispheres cyclones revolve in opposite directions—in North latitude against the course of the sun, that is from right to left, or in a direction contrary to the movement of the hands of a watch, and it is known that the wind blows in a circular course round and round a centre. It therefore follows that this centre may be considered to be at right angles to that circular course; or in other words, that the bearing of the centre lies 8 points of the compass from the direction of the wind.*

Rule.—Look to the wind's eye,—set its bearing by compass,—take the 8th point to the **right** thereof—and that will be the bearing of the centre of the storm in north latitude, if it be of a revolving type.

CURRENTS.—The surface drifts of the bay of Bengal are considered to depend very much on the monsoons, having a general tendency to flow to the north-east during the south-west monsoon, and to the south-west during the north-east monsoon, with certain inshore exceptions.

During the South-west Monsoon,† or from May to October, the current flows eastward on the south coast of Ceylon, within 30 miles of the coast, at a rate of three quarters of a mile to 2 miles an hour; but farther south, that is, between the parallels of 4° and 5° N., its direction is more southerly, or E.S.E. At this period, about 6 miles off shore, or in a line between the Great and Little Basses reefs, the current

traceable from a position westward of the Andaman islands between lat. 12° and 15° N. and long 88° and 89° E. It seems to have travelled about N. by W. from this position to about lat. 15° N. long. 88° E., when it re-curved to the eastward, and made a N.N.E. track to the head of the bay. Calcutta was on the outskirts of the storm, the diameter of which was about 500 miles, and of its centre about 12 miles. Its progressive rate was about 7 or 8 miles an hour, but towards the head of the bay it appears to have advanced more rapidly. The lowest reading of the barometer in the centre was 27·95 inches. The French ship *Pharo* and the *Saint Magnus*, over which the centre of the storm passed, although at a great distance from each other, the one entering at 4 p.m. of the 31st and the other at 10 p.m., both observed the moon, when in the calm centre, shining brightly overhead.

* It must be observed, however, that, at a considerable distance from the centre, and, before the barometer shall have fallen much below its normal value, the centre may bear 10 or 12 points from the direction of the wind; but when the barometer shall have fallen five or six tenths of an inch, the bearing of the centre may be taken as 8 points from the direction of the wind.

† Chiefly extracted from a paper on the "Currents of the bay of Bengal during the south-west monsoon," by Lieut. J. A. Heathcote (late I.N.), published in the Royal Geographical Society's Journal for 1862, p. 234.

sets to the north-east, following the direction of the coast, at the rate of from one to $2\frac{1}{2}$ miles an hour.*

On the east coast of Ceylon a strong current exists to S.S.E. and south, taking more or less the direction of the land, and running as much as 40 miles a day. This current is felt not farther than 40 to 50 miles off shore, and from its eastern limits a north-easterly set begins. About the Basses rocks it is met by that already described as setting north eastward from the south coast of the island; blending together they then take a north-easterly, and afterwards an E.N.E. direction, across the southern part of the bay.

On the coast of Coromandel, a northerly set prevails within 30 miles of the shore as far north as the parallel of 15° ; outside these limits it turns to the north-eastward. North of the parallel of 15° it takes the direction of the land as far as Godáviri point, and thence trends in an easterly, and afterwards a north-easterly, direction across the bay.

From False point to about Vizagapatam, within 30 miles of the coast will be found a southerly current of three-quarters of a mile to $1\frac{1}{2}$ miles per hour; but farther to the eastward it gradually succumbs to the influence of the south-west wind, and joins the general set in a north-easterly, and then an easterly direction, across the bay. This set, on approaching the coast of Arakan, and in about lat. 20° N., deflects to the northward, and runs strongly to the N.N.W. It thus becomes a dangerous current for vessels making Akyab in the south-west monsoon. This current may have a connection with the southerly set from False point, but in the northern part of the bay of Bengal, seaward of the Sundarbans, any constant current cannot be traced, on account of the strong rotatory tides which prevail in this vicinity. These tides set, at different periods of each tide, towards every point of the compass. The flood begins at West, at the first quarter it flows W.N.W., at half flood it is about North, the last quarter setting to the E.N.E. The ebb begins at east, half-ebb runs about south, and the last quarter ebb W.S.W., thus forming a complete rotation.

The steady blowing of the south-west monsoon across the whole breadth of the bay of Bengal would appear to cause an accumulation of waters in the

* A remarkable circumstance occurs with regard to the current during the south-west monsoon. After running 3 knots to the N.E. for ten days, suddenly it slackens, and runs from 2 to $3\frac{1}{2}$ knots S.W., or from the bay of Bengal, lasting sometimes one day, at other times for a week; these changes happen at all times of the moon, and appear to obey no recognised law. (From Report of Mr. Buchanan, master of the former Little Basses light vessel, April 1869.)

north-east portion of the bay giving rise to a current setting at the rate of three-quarters to $1\frac{3}{4}$ miles an hour to the southward, from about lat. 18° N., long. 90° E., towards Preparis island, where it curves to the eastward into the gulf of Martaban. From its eastern limits a north-easterly set begins which on nearing the Pegu coast turns to the northward, joining the N.N.W. current off the coast of Arakan.

Near the Andaman islands, the currents running to the eastward during the south-west monsoon, round the north and south extremes of the islands, meet at a short distance beyond them, become confused and irregular, and throw up high rippings, while immediately under the shelter of, or eastward of the islands, an eddy is found, running to the northward from half a mile to a mile per hour. It is probable that the easterly set extends close up to the western side of the Andaman islands, the waters becoming to a certain extent heaped up on their west side, and making their way through and round them wherever they find an opening.

In the open sea between the Mergui archipelago and the Andaman islands, the influence of the south-west monsoon again shows itself in a north-easterly set of half a mile to $1\frac{1}{2}$ miles per hour. A south-east current sets with considerable force during the south-west monsoon down through the Mergui archipelago and past the Sayer islands; and from lat. 10° N., long. 95° E., a strong current in the same direction sets, at the rate of three-quarters of a mile to $1\frac{3}{4}$ miles per hour, into the entrance of Malacca strait. This current may probably be found some degrees farther to the eastward.

Sumatra.—On the north coast of this island, near the shore, the current of the south-west monsoon follows the form of the land to the westward; on the west coast of Sumatra, the monsoons are so variable that they seldom influence the current to any great extent; still, the general prevalence of westerly winds is such as to drive a considerable body of water towards the west coast of Sumatra, where it turns to the south east along the coast with a force seldom exceeding 12 to 18 miles a day; it very rarely runs north, but in June and July, between Analabu and Achi head, a north-west current running 20 or 30 miles a day, has been experienced; probably a rare occurrence.

In the approach to Malacca strait between Achi head and Nicobar islands, the current, it is said, generally runs with the wind.* This

* In July and August, a south-westerly current running in the teeth of the monsoon at the rate of three quarters of a mile to $1\frac{1}{2}$ miles per hour, has been reported by several vessels, between Achi Head and great Nicobar. H.M.S. *Rifleman* in August 1878, experienced a S.W. set of 2 knots an hour, the wind at the time being S.E. force 2 to 3.

however, is not always the case, for at times the current is found to run obliquely with, and even contrary to, the wind.

During the North-east monsoon, or from October to April, a strong current sets southward along the east coast of Ceylon, especially in October and November. Rounding the south coast it takes a westerly direction as far as Galle, and turning to the north-west runs parallel with the coast, sometimes as far as Talavilli, in lat. $8^{\circ} 10' N.$, where it again turns to the westward. Its velocity has been estimated to average 40 to 48 miles a day, and on rare occasions it has been found to amount to 94 miles. Off Trincomali, from September to March, the southerly set is particularly strong; here, during October and November, the southerly current sometimes flows 50 to 70 miles a day. At the Little Basses* from early in October to early in February the S.S.W. current is constant, reaching its greatest force, 4 to 5 knots, in December. In February it slackens; in March it is still S.S.W., but variable and weak; and in April there is, as a rule, very little current, though occasionally a strong set to the S.S.W.

On the Coromandel coast, at the beginning and during the strength of the north-east monsoon, the current has been known to run $2\frac{1}{2}$ and 3 knots an hour to the southward, abating, however, in January and February.

Near the middle of the bay, at the distance of about 150 miles from the coast, the current begins to set to the south-west about the middle of October or beginning of November, the time when the north-east monsoon is well established; before, the current is here variable, setting S.S.W. and even N.W. or to some point between these directions. Throughout the bay in December there are little or no currents, except those produced by the tides. In January the south-westerly current loses its strength, and in February ceases. In March and April, the current is weak and variable, between the Coromandel coast and the Nicobar islands. In April the general movement of the surface drift is to the north and N.E., the current attaining its greatest strength, varying from 10 to 20 miles a day, in April and May.

In the north-west part of the bay, in the early part of the north-east monsoon, the general set is to the south-west, and near the coast of Arakan southerly or south-east currents prevail more than any other throughout the season. In the northern part of the bay the current often flows to the south in March, and to the north in April.

In the north-east part of the bay, between cape Negrais and Chittagong during the north-east monsoon, the current is seldom strong, but

* From a memorandum supplied by Mr. John Buchanan, master of the Little Basses light-vessel, April 1869.

from the middle of December to May a southerly current is occasionally experienced in this vicinity.

Near the Nicobar islands and between them and the island of Junkseylon, a strong N.W. current is often found, which sometimes sets North.

TIDES.—The tidal wave of the bay of Bengal appears to sweep up the bay from south-west to north-east, with a regularity which may be fairly traced. At Colombo four floods and four ebbs have been observed in the course of 25 hours, the difference of high and low water being only 6 inches. This may be attributed to the bifurcation of the ocean tidal wave at the Maldivh group, which has the same effect as a continent interposing. Northward from these islands two waves advance, the one, inclining eastward, toward the gulf of Manár, causes high water about simultaneously at Colombo and cape Comorin, the other being the regular wave of the Malabar coast, which causes high water later at Cochin than at Mangalore.

It is noticeable that the tide at Trincomalí on the east coast of Ceylon is six hours behind the tide at Point de Galle on the south-west coast of that island, the latter again occurring one hour after the tide at Colombo on the west coast with the same rise in each case, of two feet at springs. When it is high water at Trincomalí it is low water at Galle, and *vice versá*; whereas simultaneously at Kirindi and Batticaloa, situated intermediately between the two places, it is respectively, quarter and half tide, denoting affinity in the progress of the tidal wave in this vicinity. At Pámbam (Paumben), on the north side of Ceylon, the tidal hour is akin to that of Galle and Colombo, whereas Nagar and Madras on the Coromandel coast have nearly the same time of high water at springs as Trincomalí, differing about six hours with Pámbam, although the rise at springs of 3 feet is about the same.

On both sides of the bay the progress of the tide is distinct, both in time of arrival and increase of volume.* After passing Madras, the tidal wave continues along the west coast of the bay of Bengal and arrives later and has a greater rise as the head of the bay is approached, and the land water brought down by the Ganges and Brahmaputra met with. Thus at Cocanada the tide is forty minutes later and the spring rise has increased from $3\frac{1}{2}$ feet to 5 feet, at False point the rise increases to 7 feet, at the mouth of the Dhamra river to 10 feet, and in Balasor roads and at Saugor island at the mouth of the Húgli river to 12 and 15 feet. At the light-vessel off the entrance to the Matlá river, farther south or seaward than Saugor island and Balasor roads, and almost in the same latitude as the Dhamra river entrance and

* See Admiralty tide tables giving times and heights of high water at full and change for the principal places on the globe.

Pilots ridge, the tidal hour is about the same, and the rise at springs equal, or from 9 to 10 feet.

At the mouth of the Karnafuli or Chittagong river, in the north-east corner of the bay of Bengal, which the tidal wave reaches late, and where the volume is swollen by the waters of the Meghna river, the rise is about 15 feet, and tidal hour 12h. 45m.

On the east coast of the bay in positions near the sea coast not complicated by river discharge, the tidal hour on the day of full and change will be found almost simultaneous, and the spring rise equal, for at Akyab, Kyaukpyu, and Bassein river entrance, the time of high water is between 9h. 45m. and 10h.; and the spring rise in each case 9 feet. As we follow the tidal wave up the gulf of Martaban however, the discharge from the Irrawaddy mouths, the Sittang, and the Salween rivers is met with, the tidal hour becomes later, and the rise of tide increases.

Throughout the Andaman and Nicobar islands the tidal hour appears to vary from 9h. 15m. to 10h., and the rise at springs to fluctuate between $7\frac{1}{2}$ and $9\frac{1}{2}$ feet.

Along the Tenasserim coast, at the entrance of the Tavoy river, and in Mergui harbour, the time of high water is about the same, viz., 10h. 30m., and the spring rise about 18 feet; but at Junkseylon island, situated some four degrees of latitude further to the south, on the same line of coast, the tidal hour is twenty minutes earlier, and the spring rise of 9 feet, similar to that of the north part of Sumatra, the Andaman, and Nicobar islands.

The set of the tidal streams on the various coasts, with further information, will be found included with the more detailed descriptions of those coasts, hereafter given.

Diurnal inequality, common to the tides of the bay of Bengal, is applicable not only to the height of high, and of low water, but to the times at which high and low water occur. When the moon's declination is north (or of the same name as the latitude), the tide which takes place when the moon is above the horizon, called the superior tide, rises higher than the inferior, or the tide when the moon is below the horizon. When the moon's declination is south, the contrary is the case, or the inferior tide, which occurs when the moon is below the horizon, rises higher than the superior tide, happening when the moon is above the horizon. Generally speaking, the difference between the alternate superior and inferior high waters, has been considered, for practical purposes, the diurnal inequality. There is also a marked inequality in alternate low waters, which, for engineering purposes, it is sometimes important to take account of, as well as inequality in the time at which the high water or summit of the tidal wave arrives, and the time of the low water, or when the hollow of the tidal wave passes.

In the northern parts of the bay of Bengal, as well as on the Martaban and Tenasserim coasts, the diurnal inequality may either accelerate or retard the times of high and low water to the amount of nearly an hour, and increase or diminish the rise by upwards of a foot. The night tides are highest between September and March, and the day tides have the same advantage from March to September. In December and January there is on the springs nearly 2 feet more rise of tide in the night than in the day, but in June and July the day tides are highest.

The Bore.—As might be expected from the configuration of the land, and open accelerating tidal sweep to which the river mouths in the north and eastern part of the bay of Bengal are exposed, bores occur, especially in the cold or dry season.

The localities where bores are best known are in the Húgli and the Meghna of Bengal, and the Pegu, and especially the Sittang river of Burma. During the dry season, or in the months of January, February, March and April, if the moon at full or change happens to be at its nearest to the earth, or in *perigee* (semidiameter about 16' 30''), then the spring tides are higher than usual, and the bore-wave in the localities specified may be expected with more or less violence. In the Húgli, the bore is occasionally of sufficient height and force to throw a small boat end over end.

In the Meghna river, on the north-east side of the bay, which represents the mouth of the Brahmaputra river, the bore is common, and of a more dangerous type than that of the Húgli.

The Pegu river bore appears dangerous. In the month of April it has been described in the Pegu branch of the Rangoon river as follows:—
“Ship grounded about 11 p.m., and remained until 3 a.m., when we heard an immense noise approaching us, which turned out to be the flood tide setting in with a bore, which was about three feet high. This I conjectured was from the joining of the Sittang and Pegu branches of the river, whereby a bore is formed.*”

The bore which visits that little known river, the Sittang, is by native report most violent and dangerous. The extensive bell shaped and shallow mouth of this river, standing open to the direction of the tidal wave, seems particularly of a form and nature favourable to encourage these visitations. Reliable information on the subject is wanting, but there is little doubt that the bore of the Sittang river is formidable, both in height and velocity. Following the crest of the bore is a heavy chopping sea of sand and water, as dangerous almost as the tidal wave itself.†

* From the Remark Book of Denton H. Speer, Esq., R.N., Acting Master, H.M.S. *Serpent*, 1852.

† Imperial Gazetteer of India, vol. IX., p. 140.

THE SURFACE TEMPERATURE of the sea in the bay of Bengal is greatest in the month of August. The south-west part of the bay in that month has a temperature of 85° , but to the south-east, or near the north part of Sumatra and the Nicobar islands, it is only 79° . In the north-east part of the bay at the same season, the surface temperature varies from 80° to 85° .

In February, the latter end of the cold season, a sensible diminution in the temperature of the surface water will be found. The whole of the lower part of the bay at this time, from about the latitude of Madras to the entrance of Malacca strait, preserves an equable temperature of about 80° . Northward of this imaginary line, the sea surface appears to gradually cool to as low as 75° , and even to 72° , as the head of the bay is approached.

SOUNDINGS.—Off the south and east coasts of Ceylon, the one hundred fathom line has not yet been defined. At the distance of about ten miles from this coast the soundings are about 30 fathoms, and the bottom uneven. Midway between Trincomali and Pedro point to the northward, at a distance of 55 miles from the coast, is a bank, on which as little as 25 fathoms seems to have been obtained.* Northward of this, off the entrance of Palk strait leading to the bay of the same name, which is shallow, the one hundred fathom line appears to run parallel to the trend of the coast, at a distance from it of about 35 miles. Abreast of Negapatam it is again lost. The Coromandel coast carries bold water as a rule, gradually shoaling from about 30 fathoms at a distance 10 miles, up to the line of surf which beats upon it.

In about latitude 15° N., the deposit from the Kistna river fills in an indentation in the coast, forming the Mutapolli bank having as little as 10 fathoms 20 miles off shore. From thence northward to False point the same description applies to the Orissa coast on the north-west side of the Bay of Bengal, for here and there, a negative sounding gives indication that the one hundred fathom line is inclined to run parallel to the coast, and from 20 to 25 miles distant from it. The water shoals around the low sandy entrance to the Dhamra river and Palmyras point, into Balasor road, in which the depths are from 5 to 15 fathoms, and the decrease gradual as the shore is approached.

The Pilots ridge, on which during the south-west monsoon is placed a lightship, is the underwater extension of the Palmyras shoals from which it is distant from 20 to 25 miles, and has depths of from 17 to 20 fathoms at low water. The soundings seaward or eastward of the Pilots ridge deepen from 23 to 30 fathoms, and the bottom is an olive green mud, whereas

* These soundings are by H.M.S. *Scout*, 1863.

on the ridge inside the 20 fathom line, the bottom consists of sand, broken speckled shells, and small pebbles of a rusty red colour.

The northern part of the bay has a complicated variety of finger shaped banks, the under-water extension of the numerous low alluvial islands forming the delta of those vast rivers and their effluents, the Ganges and the Brahmaputra. Here too occurs the "Swatch of No Ground," a depression situated about midway between the Balasor and Chittagong sides of the bay. The submarine ravine is 300 fathoms deep at 15 miles from the flat mangrove islands of the delta, whilst at the same distance, the bank on each side of the Swatch is only from 30 to 40 fathoms below the surface. The bottom, in the Swatch, consists of very soft mud.

On the Burma coast, between Elephant point to the northward and cape Negrais, the soundings are more broken in character, detached islets and rocky banks abounding. Here, too, the one hundred fathom line has not been defined, but would seem to extend, with a general north and south trend, about 35 miles off shore.

The Andaman and Nicobar islands form the above water portions of a ridge which extends from the range of mountains terminating in cape Negrais to the north coast of Sumatra. Deep breaks in the Ten Degrees channel, and opening between the Great Nicobar island and the islands off the north-west point of Sumatra, occur in this submarine ridge, but on the whole it is of continuous character.

In the gulf of Martaban, where the silt brought down by the Irrawaddy, the Sittang, and the Salween rivers, succeeds in driving even the fifty fathom line to a distance of 80 miles off shore, the soundings are better defined. Off the Tenasserim coast and Mergui archipelago, the soundings vary from 100 fathoms at 100 miles off shore, abreast or westward of the Tavoy river, to the same depth at a distance of 30 miles westward of Salang or Junkseylon island. Eastward or inshore of this, the depths are as varied as might be expected in the approach to such a labyrinth of islands and rocks, though apparently seldom more than 50 fathoms.

A basin of deep water, carrying in parts over 1,000 fathoms, appears to extend from the entrance to Malacca strait, northwards towards the gulf of Martaban, about 500 miles in length by 200 in breadth, the bottom consisting of mud.

At the mouth of the bay of Bengal, the depth at a position about half way between the coast of Ceylon and the north point of Sumatra is 2,190 fathoms, over a bottom of clay (globigerina ooze), and 55 miles E.S.E. of Dondra head of Ceylon, 2,290 fathoms has been obtained. In the central part of the bay about midway between Ceylon and Chedúba island of the Burma coast, or in lat. $12^{\circ} 32' N.$, long. $80^{\circ} 58' E.$, the depth is 1,680

fathoms, and the bottom a grey gritty tenacious clay, and at distances of 150 and 280 miles north-east of this position 1,560 and 1,355 fathoms have been found, tending to show that the great depth of the mouth of the bay is co-existent in no other part, but that a gradual shoaling takes place in its bed as northern latitude is attained.*

PASSAGES.—There is no difficulty in proceeding from southern to northern ports in the bay of Bengal during the south-west monsoon, nor from northern to southern ports during the north-east monsoon. Vessels bound from a port on the east side to a port on the west, may easily do so during the north-east monsoon; so also may vessels from a western to an eastern port during the south-west monsoon. When the monsoon is contrary, it results that a vessel must work up or down as the case may be; or after standing some distance across the bay then shape course for her destination. At the change of the monsoon, the voyage may be tedious, for the light and variable winds of this period are as often adverse as favourable; every slant should then be taken advantage of, and the north-east coast of the bay avoided as much as possible, unless bound to or from one of the ports on that side of the bay.

On the Coromandel coast, the current runs strong to the south in the north-east monsoon, and to the north in the south-west monsoon; consequently, the land must be made well to the north of the port in the former season, but to the south in the latter.

If working down the bay of Bengal in the south-west monsoon, every endeavour should be made to keep well to the west of the Andaman islands so as not to make them a lee shore, in case a strong westerly gale sets in. At this season, it will be found advantageous to pass north of the Andaman islands, through the Preparis north or south channel, and then work to the southward in the comparatively smooth water found eastward (or to leeward) of those islands and the Nicobars.†

General Sailing Routes and Passages for the Bay of Bengal.—In any of these routes which lead a vessel across the south-east Trade wind, there will be a tendency for such vessel to be set to the westward with the surface drift, for which due allowance must be made.

Further information will be found in the body of this work, under the heading of “directions” for making the more important ports.

* There is probably a deep valley trending up the west centre of the bay of Bengal, and the “*Investigator*” will annually add to our information of its configuration. The position of the “Swatch of No Ground” would be about in the continuation of this valley, Commander A. Carpenter, R.N., 1885.

† Fast sailing vessels from Calcutta, in the south-west monsoon, often beat down the bay of Bengal, reaching about 100 miles west of the Andaman islands; but the wear and tear will be found great, and the saving in time but slight.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March).
1. ROUND CAPE OF GOOD HOPE TO BENGAL. (See also page 167.)	Having rounded cape of Good Hope and run down easting, steer to cross lat. 28° S. in long. 82° E. then proceed to northward tending to eastward in S.E. trade. Cross equator in long. 84° E. thence to port in Bengal. For east coast Ceylon or Coromandel coast, cross equator in long. 82° E. and make the land to southward of the port. For Galle cross equator in 79° E.	After rounding cape of Good Hope and run down easting, cross lat. 28° S. in long. 85° E., thence to northward passing 120 miles westward of north point of Sumatra. Thence to westward of Nicobar islands. From this position vessels often make north part of the bay of Bengal without tacking. If bound to Coromandel coast or east coast of Ceylon, a direct course can be shaped from position off the Nicobar islands; there is no occasion to cross equator farther east than 87° E. long.
2. BENGAL TO ROUND THE CAPE OF GOOD HOPE. (See also page 274.)	Work down the west side of the bay. Pass through Preparis south channel or Coco channel. Work to southward east of Andaman and Nicobar islands, out west through Bengal passage. Cross the equator in 89° E. keeping on tack which makes most southing. After reaching S.E. Trade winds steer for Reunion; thence 90 miles south of Madagascar, then as requisite round cape of Good Hope.	Direct to round coast of Ceylon, cross equator in 86° or 87° E. long., then south of Réunion, thence to pass 90 miles south of Madagascar. From lat. 27° S., long. 45° E. steer W.S.W. so as to make the Natal coast, then round cape of Good Hope as convenient.
3. S.W. AUSTRALIA TO BENGAL.	Steer to the north-west for the S.E. coast of Ceylon, and proceed up the western side of the bay of Bengal to destination.	Steer to the north-west through the S.E. Trade wind so as to enter the N.W. monsoon in 85° E. long.; then shape course toward North point of Sumatra, and proceed westward of Nicobar and Andaman islands up the bay to destination.
4. BENGAL TO S.W. AUSTRALIA.	Work down west coast of bay, until south enough to weather Nicobar islands; then lay out of the bay on starboard tack, cross S.E. monsoon and Trade wind, and entering the westerly winds proceed as requisite.	Steer to pass 90 miles west of Andaman and Nicobar islands, having entered N.W. monsoon proceed along S.W. coast of Sumatra, giving the islands a good berth in case wind veers to S.W. Having reached long. 110° E., stand across the S.E. Trade wind into the westerly winds, and then to the eastward as requisite.
5. MALACCA STRAIT TO BENGAL.	Pass westward of the Nicobar and Andaman islands.	East or west of Nicosars as wind permits. If east, enter the bay by the Ten Degrees channel or between Little Andaman and Kar Nicobar islands.
6. BENGAL TO MALACCA STRAIT.	Through Preparis south channel, thence for Barren island and the Sayer islands, avoiding the Andaman islands and Tenasserim coast alike.	Through either Preparis north or south channel, then shape course to the southward.
7. RANGOON OR MOULMEIN TO BENGAL.	Pass through Preparis north or south channel, thence for destination.	Pass outside shoals on coast of Pegu and south of Alguada reef, thence along coast of Burma about 30 miles distant, before stretching across to destination.
8. BENGAL TO MOULMEIN OR RANGOON.	Sight Great Coco and Table islands, pass through Preparis south channel, then steer to make China Bakir lighthouse, allowing for tidal set.	Sight cape Negrals passing south side of Alguada reef before making easting. Avoid the Baragua flats. If at night endeavour to sight the Krishna light. Make the China Bakir lighthouse.
9. BENGAL TO PORTON WEST COAST OF INDIA.	Cross equator, enter S.E. Trade wind, steer west between lat. 4° and 5° S., well north of Speaker bank of Chagos group; then re-cross equator in 62° or 63° E.* or	Down the west side of the bay and at convenient distance from coast of Ceylon. After passing cape Comorin keep in sight of the west coast of India, so as to profit by the sea breezes.

* This is the northern route, and can only be followed in June, July, and August, or when the south-west monsoon is at its height.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March)
	Run down the westing between lat. 8° and 9° S., pass south of Chagos islands. From long. 70° E. bear away to cross the equator in 62° or 63° E. and for destination. If bound to Persian gulf cross the equator in long. 52° E., if for the Red Sea cross equator in long. 48° E.	
10. COROMANDEL COAST TO ROUND CAPE OF GOOD HOPE.	Work along west coast of bay to Pondicherry, or stretch off into bay close hauled. In offing, wind will generally veer to westward, when S.S.E. course may be steered. Stand on tack on which most southing can be made to equator. When S.E. Trade wind is reached, steer to pass southward of Rodriguez and Mauritius.	Pass round the south coast of Ceylon sighting it or not as convenient. Cross equator in 80° or 87° E. long., then follow route passing south of Réunion; thence steer to pass 90 miles south of Madagascar. Having reached lat. 27° S., long. 45° E., steer to W.S.W., so as to make the Natal coast before rounding the cape of Good Hope.
11. COROMANDEL COAST TO RANGOON OR MOULMEIN.	Sight Landfall island of Andaman islands if wind hang southerly, or Great Coco island if wind draws westerly. Pass through Coco channel, thence eastward, sighting Narkondam island, and then to make China Bakir lighthouse.	Make to the northward, taking either Preparis north, or south channel, then as requisite for sighting China Bakir lighthouse.
12. RANGOON OR MOULMEIN TO COROMANDEL COAST.	Keep well out to sea if the wind becomes westerly, and endeavour to sight Narkondam island. In working south, keep west of, and a moderate distance from the Mergui archipelago. Pass through the Bengal passage, thence making the most of every change of wind, work westward towards destination.	Pass through Preparis north channel and thence direct to destination
13. COROMANDEL COAST OR Ceylon TO MALACCA STRAIT.	Steer to pass between Sumatra and Great Nicobar island, guarding against southerly set, thence through Bengal passage, sighting Pulo Buton, and keeping Malay side of strait.	If from Ceylon pass close to south end of Great Nicobar island, and endeavour to close the Malay coast. If from Madras pass through Sombbrero channel of the Nicobar islands.
14. MALACCA STRAIT TO Ceylon OR TO THE COROMANDEL COAST.	From Diamond point to Achi head, keep near north coast of Sumatra, then through Bengal passage, keeping close to N.E. side of Pulo Brasse. From a good berth off Achi head cross the equator into S.E. Trade wind, then a westerly course to same longitude as port, then north, falling in with the land on west side of Point de Galle, where west wind and east current prevail at this season.	Pass either side of Pulo Pera, borrow towards Pulo Ronda, or south end of Great Nicobar island. If bound to Galle make land to northward of Little Basses. If to Coromandel coast, keep on the Malay coast until Junkseylon is reached, thence through either Ten Degree or Sombbrero channel (Nicobars). In December and January take care to make the land to northward of intended port on account of southerly set on Coromandel and Ceylon coasts.
15. COROMANDEL COAST, OR Ceylon TO BENGAL.*	Direct. Keep a moderate distance from the land, not closing it until north of Vizagapatam.	Make casting across the bay, and nothing on the east side or in the middle.
16. BENGAL TO COROMANDEL COAST OR Ceylon.	Make southing without closing the east side of the bay. Steer for your port when 60 miles to southward of it.	Steer direct, but not too near west coast. In September, with light south winds, work to south-west keeping in soundings, or stand out to sea, making use of every available slant of wind.
17. STRAIT OF MALACCA TO RANGOON OR MOULMEIN.	Sight Narkondam island, thence steer to sight China Bakir lighthouse.	Sight West Torres island (western of the Mergui archipelago), thence steer to sight China Bakir lighthouse.

* In February and March, possibly steer direct, or stand to eastward. In September and October, stretch over to north Andaman island or cape Negrais, when 100 miles westward of either, tack to north-west.

Sailing Passage.	During S.W. Monsoon (May to Oct.).	During N.E. Monsoon (Oct. to March).
18. RANGOON OR MOULMEIN TO STRAIT OF MALACCA.	Act as in No. 12, passing south point of Junkseydon, and thence steer as requisite for Penang island.	Keep outside the Mergui archipelago, then sight the south point of Junkseydon.
19. RANGOON OR MOULMEIN TO ACHI.	Act as in No. 12, but get to westward towards Nicobar islands, or make for the north coast of Sumatra, where the west current will be favourable for Achi.	Steer direct.

For directions to or from Tavoy and Mergui, *see* footnotes, pages .

To the foregoing summary may be added the following general rules for navigating the bay of Bengal.*

Time of the Year.	Bound North or up the Bay.	Bound South or down the Bay.
From 15th January to 31st May.	Take the west side - - -	Take the east side.
In June, July, August -	Keep in the middle of the bay -	Take the east side, pass east of the Andaman islands, and round Achi head of Sumatra.
In September, October, and November.	Take the east side - - -	Take the west side.
In December and to the 15th January.	Keep the middle of the bay, and make short tacks.	Keep the middle of the bay, and make short tacks.

* Captain J. H. Miller, in the Nautical Magazine for 1843.

CHAPTER II.

SOUTH AND EAST COASTS OF CEYLON. COLOMBO TO
POINT DE GALLE, THENCE TO POINT PEDRO.*Variation in 1887, 1° Easterly.*

THE WEST COAST OF CEYLON* is low near the sea, and much planted with cocoa-nut and other trees. Inland, the mountains attain a great elevation; Adam's peak (the highest land visible from the west coast) rises to a height of 7,379 feet, but is 35 miles from the nearest sea, and veiled in haze during the south-west monsoon, though an excellent landmark for two-thirds of the year. The culminating peak of Ceylon is Pedrotala-gala, 860 feet higher than Adam's peak, and nearly 20 miles farther to the north-east. Between the coast from Galle to Colombo and Adam's peak there is much elevated country; the most useful marks are the Haycock (2,175 feet), and the Hummocks or Knuckles, which, with any other conspicuous hills, will be described under their contiguous ports.

A peculiarity, which strikes a stranger at Galle or Colombo, is the red colour of the streets and roads, contrasting with the verdure of the trees; and the fine red dust which imparts its tint to every neglected article. This is occasioned by the prevalence, along the western coast, of laterite, or, as the Sinhalese call it, cabook, a product of disintegrated gneiss, which, being subjected to detrition, communicates its hue to the soil. Along the west coast, from Point de Galle to Chilaw, breccia is found near the shores. The principal scene of the most recent formations is the extreme north of the island, with the adjoining peninsula of Jafna. Here coral rocks above high-water mark, extend across the island, where the land has been gradually upraised, from the eastern to the western shore. Sand covers a vast extent of the northern seaboard, the peninsula of Jafna, and Manár island; this is doubtless brought by the currents of the north-east monsoon from the Coromandel coast, and from the Madura shore in the south-west monsoon,

* See Admiralty charts No. 68b of gulf of Manár, scale $m=0.24$ inches, and No. 813 of south coast of Ceylon, scale $m=0.25$ inch.

across the shallows of Adam's bridge ; this barrier being formed by a ridge of rocks, and sand-banks, which sands shift about materially through the force of the ocean swell in opposite monsoons.

SOUNDINGS.*—Off the south-west coast of Ceylon, the bank of soundings extends, apparently, nowhere so much as 15 miles ; northward of Colombo, to only about 10 miles ; and to less than half that distance off Kalpentin and Kara-tivo. From the latter place the edge of the bank trends north-west towards Pámbam, and at 15 miles south of that town there is no bottom at 100 fathoms. The continuation of the bank, off the Tinneveli coast to cape Comorin, has not yet been examined ; its outer edge cannot be correctly defined, but due south of cape Comorin it stretches 45 miles off shore. Behar bank, having 30 to 36 fathoms water over it, is situated 57 miles westward of Point de Galle.

The COAST.—To the north of Colombo, in the cinnamon gardens of Kadarani, standing 5 miles apart, are two towers, each 100 feet high, which mark the ends of a base line, measured in 1845, from which the trigonometrical survey of the island of Ceylon commenced ; these towers are not discernible from Seaward. The shore line, from the mouth of the Kalani-ganga to Negombo, holds tolerably straight for 14 miles, and is low and sandy, and fringed with cocoa-nut trees.

The soundings near the coast north of Colombo, are more regular than farther southward ; shoal water extends a greater distance off shore, but, the bottom being almost all mud within a line drawn from Colombo fort to Negombo point (except the rocks at the mouth of the Kalani-ganga), a vessel may stand in to 7 fathoms, by day, in fine weather.

A steep bank of coral lies in a narrow strip, parallel to the coast, about 8 miles off Colombo, extending a few miles southward, where it has 18 and 20 fathoms, and northward till nearly abreast Negombo, where it is shoalest, having 11 or 12 fathoms, with 18 or 19 fathoms inside. With Colombo bearing S.E. by E., distant 12 miles, the bank has 15 fathoms, outside of that it deepens to 23 fathoms, and, at 2 miles westward from it, there is 28 fathoms, green sand. Within the bank there is 25 fathoms opposite Colombo, gradually shoaling towards the shore. The edge of the bank of soundings is only 3 or 4 miles outside this coral bank.

COLOMBO.†—The coast about Colombo is low, and not visible from seaward more than 10 miles. The lighthouse, which is also the clock tower, All Saints church spire (the only spire) and the black dome of

* In 1874 a bank, several miles in length with 12 to 16 fathoms over it, was reported about 13 miles westward of Point de Galle ; and, in 1879, the French corvette *Victorieuse* found $9\frac{1}{2}$ and 12 fathoms near the position indicated.

† See plan of Colombo harbour, No. 914, scale $m = 10 \cdot 4$ inches.

the Dutch church are the most conspicuous marks. * The flagstaff is about 200 yards to the north-west of the lighthouse. When making the port from southward, mount Lavinia white house is a useful object for identifying this part of the coast. There are some isolated hills at a distance in the country, and the high mountain cone called Adam's peak, 7,379 feet above the sea, has been seen in clear weather at a distance of 90 miles. In the north-east monsoon it is sometimes visible, but is rarely seen during the south-west monsoon, owing to the humid atmosphere which then prevails.

DIRECTIONS.—Sailing vessels bound to Colombo, during the south-west monsoon, from south of the equator, should not cross it to eastward of long. 77° E., as between lat. 3° N. and the coast of Ceylon a strong current sets to eastward, and the wind frequently hangs from west until the gulf of Manár is entered, thus making it difficult to fetch the port if not well to windward. The coast for 20 miles south of Colombo may be approached with safety to a distance of 3 miles.

Making the Harbour at night in steamers from the westward, steer for the red light on the end of the breakwater on an E. by S. bearing until the Clock Tower light bears S.E. by S. $\frac{1}{2}$ S., then anchor if not intending to enter before daylight. In this position is $8\frac{1}{2}$ fathoms, good holding ground. In approaching from the southward, do not come under 10 fathoms until the red light bears N.E. by E., which clears Tartar rock, and then proceed as in coming from the westward. If intending to enter at night, make the usual signal for a pilot when about 3 miles off the port; and when in the position given for anchoring, heave-to head to N.W. in the south-west monsoon, to make it safe for the pilot-boat to board on the lee side, and wait till the pilot comes out giving an occasional turn to windward to hold position. In the north-east monsoon stop in the position indicated and wait for the pilot. The signal for a pilot is answered from the time signal flagstaff, and the pilot-boat proceeding to the vessel shows a flare-up light occasionally after passing the breakwater head. When the authorities consider it unsafe to bring the vessel into the harbour †—two blue lights are burned with a few minutes interval, and this indicates that the vessel should anchor.

Sailing vessels approaching at night with a fair wind should act as recommended for steamers. In working up from the southward against a northerly wind they should not, when on the port tack standing in shore come under 10 fathoms until the red light on the breakwater bears eastward

* Navigating Lieutenant W. H. Petley, H.M.S. *Alert*, February 1882.

† Since the completion of the breakwater no instance of this being necessary, has occurred (Master Attendant, Colombo, August 1886).

of N.E. by E., and when in the position already given should anchor, as sailing vessels are not brought into the harbour at night.

DANGERS.—Drunken Sailor, a ledge of rocks with 7 feet water over the shallowest part, which bears nearly W.S.W. from the light-tower, is distant off shore about half a mile. On this danger, during the south-west monsoon, the sea breaks, but not during the north-east monsoon, or with smooth water, and it will then be prudent not to come under 10 fathoms when in the vicinity of these rocks.

A black buoy is placed, during the north-east monsoon, from October 15th to April 15th, about half a cable westward of Drunken Sailor. Vessels should always pass to the westward of the black buoy.

Tartar Rock.*—Another sunken rock, with 20 feet water over it, lies about 6 cables northward of Drunken Sailor, and bears W. by N. from Custom-house point, and N.W. from the flagstaff.

A red buoy is placed about half a cable to the north-west of Tartar rock, to which all vessels must give a clear berth of half a cable. It is advisable for vessels to pass to the westward of the red buoy.

Colombo roadstead, exposed to the south-west monsoon, is safe for vessels well found in ground tackle, but since the completion of the breakwater is seldom used, except by vessels seeking cargo. Vessels formerly rode out the monsoon at single anchor, with a long scope of chain in from 7 to 9 fathoms. Communication between the shore and shipping is seldom interrupted, although there are occasional spells of squally weather and a high sea during the south-west monsoon.

INNER HARBOUR, pilotage for which is compulsory, is sheltered from the south-west monsoon by the breakwater, which is now completed, and affords good and safe anchorage for vessels of any size.†

Moorings.—Four lines of moorings, with six buoys about one cable apart, in each, are laid down parallel to the breakwater, affording 20 berths for large vessels. Vessels are berthed by pilots between the buoys, head to northward during north-east monsoon, when the spaces between each tier of buoys serve as channels up and down the harbour; and head to westward during south-west monsoon, when the space between the second and third tier of buoys from the breakwater is reserved as the channel, for which at night, the red and green leading lights in one, serves as the leading mark.

The Breakwater, the foundation stone of which was laid by H.R.H. the Prince of Wales on the 8th December 1875, is carried out from near

* It is contemplated to remove Tartar rock by blasting. (J. Donnan, Master Attendant, Colombo, 1882.)

† By the port regulations, vessels remaining in the port more than twelve hours must moor head and stern. (Nav. Lieut. W. H. Petley, H.M.S. *Alert*, 1882.)

Custom-house point in a N. $\frac{3}{4}$ E. direction for about $\frac{3}{4}$ of a mile, terminating in a lighthouse, from which a fixed red light is shown. The breakwater encloses an area of about 500 acres, a portion of which is deepened by dredging.

The Ballast ground is westward of the port, where vessels may discharge ballast overboard, in not less than 12 fathoms water; but parties on shore can be found willing to take stone ballast from a ship. The penalty for throwing ballast overboard within the prescribed depths of water is 200 rupees.

Supplies.*—Fresh water is brought alongside in tanks. Beef, mutton and vegetables in quantity and of moderate price.

Coal may always be had, and is conveyed to ships in lighters. Repairs to machinery can be effected.

In 1885, the number of steam vessels that entered the port was 980, the tonnage of which amounted to 1,873,868 tons; and there also entered sailing vessels (including native craft) whose tonnage amounted to 155,749 tons.

Colombo is connected by railway with Kandi and Káltura.

Exports to Europe consist of arica nuts, cardamoms, cinchona, cinnamon, coffee, cocoa, cocoanut oil, copperah, coir cordage, ebony, hides, horns, pepper, plumbago, satin-wood, tea, &c. &c.; and the trade is increasing.

TIME SIGNAL is made by a semaphore (painted red and white, in bands) on the flagstaff at the Master Attendants' office which is raised to an angle of about 45° at 4h. 10m. P.M.; horizontal at 4h. 13m.; and dropped at 4h. 15m. P.M. Colombo mean time—equivalent to 22h. 55m. 37s. mean time Greenwich. Time is transmitted to Colombo by telegraph from Madras observatory daily at 4h. P.M., by which the semaphore time is regulated. The signal is not made on Sundays, or public holidays.

WINDS and WEATHER.—A gale of wind, but of no great violence, may occur about the changes of the monsoon, in the months of May, June, and November, and even as late as December; though a gale in the latter month is rare, and several years sometimes pass without anything beyond a stiff monsoon breeze.

At the opening of the year, the north-east monsoon is at its height; parching and disagreeable by day, and cold, dry, and cutting at night. At this period, from noon to about 7 or 8 p.m., the "along-shore wind," as it is called, is experienced, and is avoided as injurious to health. Towards

* Colombo has superseded Galle as the port of call of the various mail steamers in the East. A government steam vessel makes the tour of the coast of the island twice a month; from Colombo either north-about, touching at Pambam, Jafna, Point Pedro, Trincomali, Batticaloa, Hambantotti, and Galle, or south-about with the above order of calling reversed.

the close of the month the wind gets a slight westerly tendency, and occasional showers fall. February is dry and hot by day, but the nights are cloudless and cool. The wind is unsteady after about the 20th, when the land and sea breezes generally set in. Rain is rare; only two inches fall during the month. In March the heat increases. Towards the end of this month, showers sometimes fall and squalls off the land, with thunder and lightning, occur in the evenings.

April is the most oppressive portion of the year, the mean temperature by day being about 88°. Land and sea breezes prevail, but with a southerly tendency, and the squalls off the land in the evening become more frequent. About the middle of the month there is generally a few days spell of south-west winds, which is called the little monsoon. Towards the end of the month a ground swell from westward shows that the south-west monsoon is not far distant, and the sea breeze towards sunset brings showers. May in the commencement is hotter than April. About the middle of the month, the south-west monsoon bursts with a violence which seldom lasts more than a few hours, and then gradually abates; after which for some days heavy showers fall at intervals; the wind remaining steadily in the south-west quarter. In May the average rain-fall is about 12½ inches. In June the south-west wind gains strength; and the temperature is modified by clouds and frequent showers. July is more moderate, and showers less frequent, the average amount of rainfall being about 5½ inches.

August and September are fine months, with light westerly breezes as a rule. The nights are clear and cool. October has more unsettled weather, but the sea is smooth, and the wind is not strong, though it veers more to northward.

In the early part of November the wind veers between N.N.E. at night and north-west by day; about the middle of the month the westerly monsoon is over, and the north-east monsoon is ushered in by lightning, thunder, and heavy rain, though the atmospheric disturbance is not so great as that of May. The average rain-fall of November is about 13 inches. In December the north-east monsoon is steady and of moderate strength, bringing with it light but frequent rains, the total quantity of which, however, does not amount to half that of November. In this last month of the year, as in the first, the along-shore wind is dry and cutting.

TIDES and CURRENT.—The current off Colombo is subject to considerable variation, particularly about the changes of the monsoon, when it is strongest, but, generally speaking, it sets with the monsoon, parallel to the coast, and is never so strong as to cause much inconvenience to vessels making Colombo. As a general rule, the current sets into the gulf of Manár in the south-west monsoon and out of it when the north-

east monsoon is fairly set in, or from the end of November to the middle of February. It is high water, full and change, at Colombo at 1h. The difference between high and low water is about 2 feet at springs, and a few inches only at neaps.

LIGHTS.—A *group flashing* white light, showing *three flashes* in quick succession every *thirty seconds*, each flash lasting *two seconds*, separated by an eclipse of *three seconds*, and followed by an eclipse of *eighteen seconds* is exhibited from the clock tower standing in the centre of the fort. The light is dioptric, of the first order, elevated 135 feet above high water, and is visible in clear weather at the distance of 17 miles.

From a lighthouse on the extremity of the breakwater, is shown a fixed *red* light, elevated 56 feet above high water, which should be visible in clear weather from a distance of 12 miles.

Harbour Lights.*—A fixed *green* light is shown from the west end of the coal depôt; a fixed *red* light is shown inshore of the *green* light. These lights should be visible in clear weather from a distance of about 3 miles, and kept in line bearing S. 6° W. (or parallel with the direction of the breakwater) lead midway between the second and third lines of buoys.

A fixed *red* light is also shown from the extremity of the landing pier.

Pilots.—A pilot-boat (a rowing boat displaying a jack on a staff in the bow) boards vessels (except native craft) standing for the port, about one mile outside the breakwater. Pilotage is compulsory to all vessels above 200 tons. At night, pilots board steamers showing a blue light, but not sailing vessels, which are only brought into harbour during daylight.

MOUNT LAVINIA is a rocky headland 6 miles to the southward of Colombo. On it is a conspicuous white building. A narrow rocky bank, with one fathom water, lies along the shore southward of the mount, and extends more than half-way towards Digorella bank. Off Pántura and Káltura, soundings of 10 fathoms are not found within 2 miles of land; but abreast of mount Lavinia, that depth is less than half a mile off, and westward of Colombo fort a full mile off. Southward of Colombo, along the shore, lies the suburb of Kolpetti, with its numerous villas. A considerable space is left clear of houses on the south of the fort; this is called the Galle-face.

PÁNTURA.—This large town, bearing S. by E. $\frac{3}{4}$ E., $7\frac{3}{4}$ miles from mount Lavinia, is at the mouth of a river which flows from Pántura lake. On the south side of the entrance, are two rocks above water, surrounded

* These lights are not visible from outside a line drawn in continuation of the straight portion of the breakwater (Master Attendant, Colombo, August 1886).

by others under water ; the outer rock, known as Gonagala, stands nearly one mile W.S.W. from the town, and has a depth of 8 fathoms close outside. The anchorage is to southward of these rocks in 10 or 12 fathoms, nearly 2 miles off shore. A high tree stands behind the cocoa-nut trees, $2\frac{1}{2}$ miles northward of Pántura, and nearly one mile from the beach. About 2 miles W.N.W. from this tree, is a rocky bank of 3 fathoms, about one mile in length, lying parallel with the shore line and half a mile off, opposite the village of Digorella.

Nilkete rock, with a depth of 2 fathoms, and on which the wreck of the steam vessel *Justitia* was lying in 1885, is situated in lat. $6^{\circ} 41' 00''$ N., about $1\frac{1}{2}$ miles from the nearest shore, and about $1\frac{3}{4}$ miles south-west of Pántura.

A rock, with 4 fathoms over it, lies W.N.W. from Nilkete rock, distant half a mile. Two small rocks, with depths of 3 fathoms, lie S. by W. from Nilkete rock, at the distance of about 3 cables.

Kaluwattegala rock with a depth of $3\frac{1}{2}$ fathoms, lies about $2\frac{1}{2}$ miles off shore, in about lat. $6^{\circ} 38' 00''$ N., long. $79^{\circ} 53' 15''$ E.

Veyangula rock, with $5\frac{1}{2}$ fathoms on it, lies W.N.W. from Kaluwattegala rock, distant about 6 cables.

Desaster rock, off a village of that name, stands close to the shore about $1\frac{1}{4}$ miles to north-west of Káltura fort ; there are sunken rocks both to north and south of it.

The COAST southward of Pántura, to Káltura is low and sandy, and abundantly planted with cocoa-nut trees. There is canal communication between these places and Negombo. Inland, some 25 miles eastward from Káltura, is a range of hills, the two southern hummocks of which, known also as the Knuckles, are useful landmarks in clear weather for this part of the coast, in navigating near which, caution should be used, and the 10 fathom line kept outside of.

Uheli Shoal, formed of coral, is about three-quarters of a mile long and one-quarter of a mile broad, it lies parallel with the shore, and has from $3\frac{1}{2}$ to $4\frac{1}{2}$ fathoms on it, $5\frac{1}{2}$ to 8 fathoms close to on the inshore side, and 9 fathoms close outside. The $3\frac{1}{2}$ fathoms patch is on the southern part of the shoal, from whence Káltura fort bears E. $\frac{1}{4}$ N. distant $2\frac{1}{4}$ miles.

Ships should not come under 20 fathoms off Káltura, on account of foul ground both to the north and south, unless intending to anchor in the roadstead. Approaching Káltura from southward, steer for the fort when it appears in line with Adam's peak, bearing about E.N.E., which will lead well clear of Two-fathoms rock to southward, and Uheli shoal to

northward, and anchor in $5\frac{1}{2}$ or 6 fathoms water, but it is rocky out in 15 or 16 fathoms.

Two-fathom rock.—This rock lies a mile off shore, and $1\frac{1}{4}$ miles S.W. $\frac{1}{2}$ S. from Káltura fort; it has a depth of 12 or 13 feet on it, and does not break, except in such bad weather as would forbid a ship communicating with Káltura. The rock is in the line of 6 fathoms, so that small vessels may pass between it and the shore in 4 fathoms, but large ships should not shoal under 20 fathoms by day, or 28 fathoms by night. Another rocky patch, with 3 fathoms water, lies S. by E. $\frac{1}{2}$ E., a short 2 miles from Two-fathom rock, and $1\frac{1}{4}$ miles northward of the high rock, called Nawoelli-kandi.

Nawoelli-kandi rock.—Nearly one mile off Maguna point stands a high rock called Nawoelli-kandi, and a sunken rock lies half a mile to the southward of that high rock.

KÁLTURA FORT, on the east bank of Kalu-ganga river, and about three-quarters of a mile N. by E. from its entrance, bears from Pántura S.S.E., distant 8 miles. The land on which the fort stands is slightly elevated, and about half a mile within the average line of the sandy shore which extends from Káltura to Maguna point, $1\frac{1}{2}$ miles to the south-west of Beach hill. A railway connects Káltura with Colombo. At the former place is now a considerable town with a rest house and other conveniences. The mail coach to Galle runs daily from Káltura.

Fanny rock, with $3\frac{1}{2}$ fathoms water on it, and 13 fathoms close to and around it, lies off Barberin island. From the rock Barberin island bears E.S.E. distant $2\frac{1}{4}$ miles, and Beach hill N.E. by E. About $1\frac{1}{4}$ miles N.W. by W. from this rock is a patch of 7 fathoms. It will be prudent not to shoal under 20 fathoms by day, or 28 fathoms by night, when passing the place.

BARBERIN ISLAND, standing about 2 cables off the main land, to which rocks connect it, bears from Káltura fort, S. $\frac{1}{2}$ E., distant $7\frac{1}{2}$ miles. It is 3 miles N.W. by N. from Bentotti river, and most of the intermediate coast is rocky. This island, being small and so close to the shore, is not easily perceived, except when near; there is anchorage to northward of it in 6 or 7 fathoms, and a small bay farther in, with 2 fathoms, sandy bottom, where small craft may anchor.

BENTOTTI RIVER entrance is 3 miles south of Barberin island; the town of Bentotti is on the south bank, and half a mile from the bar, on which there is only 3 or 4 feet water, but the depth varies according to the season, being greater after heavy rains, when the bar becomes navigable for the native coasting craft. In the river there is a depth of one and 2 fathoms. As the sands on the bar frequently shift,

and there is generally a surf, boats should not attempt to cross it without a pilot.

UDAPITTA POINT, on the south side of entrance to Bentotti river, bears N. by W. $\frac{1}{2}$ W., 3 miles from Unapayagalle, is rocky and of moderate height, with several rocks above water lying off it. Andevan rocks are two rocky islets lying W.N.W., half a mile from this point; there is a depth of 6 and 7 fathoms close outside of them, and 4 or 5 fathoms between them and the sandy point which dries off Moderi-galle (the rocky point that forms the south side of Bentotti river, as well as the northern extreme of Udapitta point); but no vessel should pass between Andevan rocks and the point, for there are several rocks having only 3 or 4 feet water.

Dodompara rocks, showing above water, are three-quarters of a mile north-west from Unapayagalle point, and half a mile off the nearest shore, abreast a small hill called Galbodi-Kandi, which is a like distance from the beach; between these rocks and Udapitta point lie several other rocks with from 3 to 6 feet water on them, and from one-quarter to half a mile off shore; outside these rocks there are 5 and 6 fathoms water, sandy bottom, with occasional patches of coral.

Kerevanni rock, a small white-topped rock, stands a quarter of a mile south-west from Unapayagalle point; and one mile west from this rock is the north extreme of Utari, a rocky bank having a depth of 4 to 5 fathoms, extending southward till within half a mile seaward of Napa rock.

UNAPAYAGALLE POINT, bearing S. by E. $\frac{1}{4}$ E., $3\frac{1}{2}$ miles from Udapitta point, is low and rocky, and continues so for one mile in a southerly direction to Nyakandugalle point, but between this last and Kosgoddi hill the shore is sand.

BANK.—Horsburgh's India Directory mentions a bank, having 30 and 32 fathoms water, with 37 and 38 fathoms between it and the land. From it, Haycock mountain (16 miles inland of Kosgoddi hill), bore about East; the distance from shore was about 15 miles, and it extended a considerable distance to the southward. The latest charts exhibit a similar bank, 20 miles in length north and south, lying parallel to the shore and 9 or 10 miles off, between Barberin island and Akorali point; and it probably extends still farther southward, as there are indications of it 13 miles due West from Point de Galle.

Napa rock, lying $1\frac{1}{4}$ miles due north from Alut rock, and one mile off shore, has 2 fathoms water on it, and 8 fathoms close outside; it forms the northern extreme of Konda bank, which extends southward to half a mile inshore of Alut rock.

Alut rock.—This rock, having only 8 feet water on it, and deep water all round, lies $1\frac{1}{2}$ miles west from Ahungalle point. From the rock, Haycock hill is in line with the house on the summit of the cliff near Ahungalle point. To pass outside of Alut rock, Gindavana islet should be kept open of Myimba rocks; and no vessel should shoal under 20 fathoms by day, or 28 fathoms by night.

AHUNGALLE POINT, bearing North, 2 miles from Muta Amarata Boka, is low and rocky, and forms the southern extreme of some rocky cliffs half a mile in length; the northern end is of considerable height and called Kosgoddi hill. On the summit of the cliffs near Ahungalle point stands a house conspicuous from seaward.

HARISPOL POINT, three-quarters of a mile north from Balapitti river, is low and sandy, but has several high rocky islets lying close off it; between it and the river mouth, are several rocks above water, surrounded by a reef, between which and the shore there is anchorage off the bar of the river in 2 fathoms, sandy bottom; the passage is between this reef and Balapitti Modere point. Several rocks, having only from 2 to 6 feet over them, lie from one-quarter to three-quarters of a mile off this part of the coast.

MUTA AMARATA BOKA POINT (the Cocacheira point of Horsburgh), bearing N.N.W. distant $5\frac{1}{2}$ miles from Akorali point, is rocky and of moderate height. The two Myimba rocks, a few feet above water, and surrounded by reef, stand one-quarter of a mile westward of the point; and, close to the north of it, is the entrance of Balapitti Modere, a river which is small, and navigable only by dhonies. A custom-house stands on the north side of the entrance, where the shore is low and sandy, and not so prominent as the south side, called Balapitti Modere point, which is rocky and slightly elevated.

WATHU BANK.—The village of Amblam is $1\frac{1}{2}$ miles to northward of Gindavána, and off it, nearly one mile from the shore, lies Wathu or Balu bank, having 3 fathoms water; this seems to be connected with the bank on which stand Myimba rocks.

GINDAVANA ISLET, rocky, and of moderate height, stands at the distance of 2 or 3 cables from the shore, and bears N.N.W. from Akorali point rather less than 3 miles. Amblangoddi rest-house, a conspicuous building from seaward, stands on the summit of a rocky cliff, half a mile S.E. by E. from Gindavana; close to the southward of the rest-house, is an opening in the rocks forming a cove, with a sandy beach about 100 yards in extent, and anchorage in $2\frac{1}{2}$ fathoms water. A small river has its mouth to the south of Amblangoddi, and off it are several rocks. Off Patiagalle point, which is three-quarters of a mile S.E. by S. from Gindavana

islet, is a rock called Radul. White coral is found on this part of the coast, and shipped to Colombo and Point de Galle, where, when calcined, it forms lime used for building purposes.

Passi rock is small, above water, with a bank extending from it about 2 cables to southward, on which the sea breaks heavily; this rock bears West, a long mile, from Akorali point; and upwards of half a mile farther out is a sunken rock; another rock is also said to lie 3 or 4 cables northward of Passi; there is a passage between the latter and the shore, but a ship should always pass well outside.

Túng and Vatang rocks.—Off Akorali point lies Túng rock, and half a mile north-west from this, Vatang rock; several shoal spots extend more than one mile off shore, with from 6 to 9 fathoms water between them.

AKORALI POINT, called also Webille, bears S.S.E. distant $5\frac{1}{4}$ miles from Muta Amarata Boka point; it is low and sandy, and covered with cocoa-nut trees, and shoals extend off it for about a mile.

Debaha rock stands about half a mile south-west from Senegammi low rocky point, and bears from Waal islet N.N.W. $\frac{1}{2}$ W., $1\frac{3}{4}$ miles. This rock is elevated a few feet above the water, and has the appearance of being split into two. Midway between Senegammi point and Waal point are the creek and village of Iikadowi, with a traveller's rest-house, hidden by cocoa-nut trees; a gap in the reef, which fringes the coast, affords a passage for small boats to anchorage off the village.

WAAL ISLET is situated 3 cables off Waal point, and bears north-west from Manda islet distant $2\frac{1}{3}$ miles; it is high and rocky, with smaller islets near it. Waal point, (Ragamma point of Horsburgh,) is low, and covered with cocoa-nut trees. Hikodi rock lies $1\frac{1}{4}$ miles S.S.E. from Waal islet.

DODANDOWI is a village with a custom-house on a small river 7 miles S.E. $\frac{3}{4}$ S. of Akorali point and 4 miles north-west from Gindura town; the river entrance is north of the village, and has two rocky islets off it, at less than one cable from the sandy shore; the northern islet called Medda, affords some shelter from southerly winds to the landing place at the river's mouth. Manda, the southern islet, is on the shore reef, and one cable from Medda, and bears N.W. $\frac{1}{4}$ W., $7\frac{3}{4}$ miles from Point de Galle lighthouse.

Anchorage.—Dodandowi outer anchorage is in 6 or 7 fathoms, sand, 2 cables to the north-west of Medda islet, and with the breakers on Dodandowi rocks bearing about S.S.W., but small vessels may go farther in till Manda islet disappears behind Medda, and anchor in 5 fathoms, equi-

distant from Medda islet, from the sandy shore to the east, and from Gona, rocks to the northward.*

Dodandowi rocks, always breaking, lie 2 cables W. by N. from Manda, and there is a fair channel between; but Orava rock, with 6 feet water on it, is situated one cable N.N.W. $\frac{1}{4}$ W. from Dodandowi rocks,† so it will be prudent to pass westward of both these dangers in either entering or leaving Dodandowi anchorage.

Hikodi rock, the outermost danger in Dodandowi bay, lies nearly $1\frac{1}{4}$ miles W. by N. $\frac{1}{2}$ N. from Medda islet, and one mile from the nearest sandy shore; it is small, has 6 feet water over it, 7 fathoms all round, and 15 fathoms at one cable to seaward. Half a mile inshore of it, lies Un reef, between which and Hikodi rock is a passage for vessels, but they had better keep outside of all these dangers.

To pass westward of Hikodi rock, Debaha rock must be kept well open westward of Waal islet; and Medda islet on with Dodandowi Modere, bearing East, will clear it to southward. In passing along this part of the coast, do not come under 30 fathoms, the soundings being irregular, and the bottom rocky toward the shore.

TIDES.—It is high water, full and change, at Dodandowi bay at 1h. 50m.; ordinary springs rise $1\frac{1}{2}$ feet.

GINDURA RIVER is nearly midway between Manda islet and Point de Galle, and may be known by the different character of the coast on each side of it. To the north-west of the river entrance the coast is low and sandy, to the south-east it is rugged and rocky. From Waal or Raganma point to Point de Galle the shore has a level appearance, covered with cocoa-nut trees, and is dangerous to approach under 20 fathoms by day, or 30 fathoms during the night, several rocks being situated from one to two miles in the offing, some of which are nearly dry.

God-da bank, the least water on which is 4 fathoms, with rocky bottom, lies $3\frac{1}{2}$ miles north-west from Gindura rock, and $1\frac{1}{2}$ miles south-west from Dodandowi village. It may be avoided by keeping Senegammi point (which is just inshore of Debaha rock) open to the left of Waal island.

THE SOUTH AND EAST COASTS of Ceylon are for the most part of a moderately bold nature, bordered with rocky points and sand beaches, not free from off-lying rocks, and subject to dangerously strong currents, which render great vigilance necessary when navigating in the vicinity.

* See plan of Dodandowi bay, on chart, No. 813, scale $m = 2.8$ inches.

† A bank (Kadul bank) the depth on which is unknown is said to lie half a mile south-westward of Manda islet.

That part of the coast between Julius Nave point and Batticaloa has not been thoroughly surveyed, and it is therefore well not to approach it nearer than is absolutely requisite especially at night.

Caution.—Sailing vessels approaching Point de Galle harbour should be careful to keep a weatherly position to enable them to sail in, and it should be borne in mind that the current sets along the line of coast with great velocity, to the east during the south-west monsoon, and to the west during the north-east monsoon. Vessels during the south-west monsoon by getting to leeward of the port, have taken weeks to regain their lost ground, and in some cases have been compelled either to bear up for Trincomalí, or to recross the equator.

POINT DE GALLE HARBOUR* is formed between Point de Galle and the sloping land eastward, on the highest part of which stands Edwards pillar; thence the land trends to the south-east, terminating in Unawatti low point, which projects farther seaward than the south west bluff point. Watering point, upon which stands a white tower, is a rocky bluff a little more than a mile E. by S. $\frac{1}{2}$ S. from Point de Galle, and forms the eastern limit of the harbour. The actual entrance is narrowed, and the anchorage within much confined, by numerous dangerous reefs, having only from 3 to 15 feet water over them. At the head of the harbour is a low sandy beach bordered with cocoa-nut trees. Near the centre are two rocky promontories known as Gibbet island and Glosen-burg. The anchorage frequented by shipping is in from 6 to 4 fathoms sandy bottom, on the west side of the harbour, abreast the fort. The land in the vicinity of Point de Galle is comparatively low and ill-defined, but the position of the harbour may be readily known by the lighthouse, which stands at the west point. On this point the fort and town are built, the sea front being rendered inaccessible by a line of coral reefs, on which the sea breaks heavily. Off the light-house point several rocky islets extend a quarter of a mile to southward. These dangers are all above water, and may therefore be easily avoided; but the principal difficulty exists in the strong currents which run to east or to west (according to the monsoon) past the submerged outer shoals.

Point de Galle harbour is considered a safe place in all seasons of the year, but with strong south-west winds a ground swell tumbles in; it is frequented as a port of call for orders, in consequence of the telegraph, communicating with India, Europe and China.† The mail vessels no longer

* See Admiralty charts, Point de Galle harbour, No. 820; scale, $m = 11\cdot8$ inches; Approaches to Point de Galle harbour, No. 819; scale, $m = 3$ inches, and Indian ocean, Ceylon, south coast, No. 813; scale, $m = 0\cdot25$ inch.

† Galle was the *Kalah* of the early Arabians, and is the locality of the *Tarshish* of Scripture. (Sir. E. Tennent on Ceylon, vol. 2, p. 100.)

call at Galle, but at Colombo, the trade and importance of Galle has suffered of late years, in consequence.

Supplies of every kind, including coal, can be obtained. Water may be procured from a small bay within Watering point, where is an excellent spring and a wooden pier. Native boats and crews can be hired to supply ships with water.

LIGHT.—A *fixed white* light, catoptric of the second order, is exhibited from an iron tower, 80 feet high, and painted white, on the south bastion of the fort on Point de Galle; the light is 100 feet above sea level, and visible in clear weather from the distance of 12 miles.

WESTERNMOST DANGERS. — **Gindura rock.** — This rock, called Medda by the natives, lies nearly two miles S.W. by W. from Gindura river mouth, and W. by N. $\frac{1}{4}$ N. nearly $4\frac{1}{4}$ miles from Point de Galle lighthouse. From its shoalest part, which has only 6 feet water, and is very dangerous, as the sea does not always break over it, Haycock mountain appears a little to the left of the Gull, a small white-topped rock near the beach, one mile north-west of Gindura town; there are depths of 4 and 5 fathoms around the rock at about two-thirds of a cable from it, and 15 fathoms at two cables outside of it. A small coral patch, of 3 fathoms, lies rather more than half a mile N.E. by E. $\frac{1}{2}$ E. from it, and there is a depth of 16 fathoms between them. The channel within Gindura rock should be avoided.

Buoy.—An iron nun buoy, painted *red*, and surmounted by a flag, lies in 11 fathoms, about 2 cables southward of Gindura rock. From this buoy, Edwards pillar is just open south of the lighthouse.

To pass outside of Gindura rock, Akorali point (to northward) must be kept open to the left of Waal island; or Unawattt point kept well open outside the breakers of Whale rock.

Vessels running from Colombo to Galle should be careful to sight Edwards pillar to the right of Point de Galle lighthouse before Akorali point is allowed to come on with, or eastward of, Waal island.

Whale rock, under water, bears W. $\frac{3}{8}$ N. $2\frac{1}{2}$ miles from Point de Galle lighthouse, and is $1\frac{1}{2}$ miles from the nearest shore; it always breaks, but in fine weather only once in four or five minutes, so that a good look-out is necessary. There is no safe channel inside of it, the bottom being rocky, and the soundings irregular. A bank lies about midway between Whale rock and the shore, with $3\frac{3}{4}$ and $4\frac{1}{2}$ fathoms on it, and there are many shoal spots within half a mile of the coast. There are 7 fathoms close outside Whale rock, 12 fathoms at 2 cables, and 20 fathoms at less than half a mile off. The soundings between Whale and Gindura rocks deepen gradually from 8 fathoms near both rocks to 16 fathoms midway between them.

Little Whale rock (Grampus) is a small rock above water, lying about half-way between Whale rock and Point de Galle lighthouse, on nearly the same line of bearing. There are many rocks inside of it, with from 3 to 6 feet water on them. Vessels, therefore, if driven to the necessity of passing inside the Whale, should be careful to haul out between it and the Little Whale, where is a clear channel with 8 to 10 fathoms, rocky bottom. A small bank, called Kadra-wella, lies about 3 cables south-east of the Little Whale, with a depth of 8 fathoms.

OFF-LYING DANGERS.—Kadda rocks consist of disconnected patches, 2 cables in extent, N. by E. and S. by W., with only 12 feet on the shoalest part. There is deep water between the rocks. During the south-west monsoon, heavy breakers extend the whole length of the rocks; but in the north-east monsoon there is seldom a break.

Outer Kadda, on which the least water is 13 feet, lies S. by E. $\frac{3}{4}$ E. about two-thirds of a mile from Point de Galle lighthouse, with Pilot tree (on Mudlia hill, 157 feet high)* and Sailor bastion in line, and the white mark on the east side of the bay almost shut in with Watering point.† A bell-buoy painted red is moored on the East side of the rock, but is liable to break adrift.

Middle Kadda, with 12 feet on it, lies about $6\frac{1}{4}$ cables S.S.E. of Point de Galle lighthouse, and nearly midway between the Inner and Outer Kadda rocks.

Inner Kadda has 15 feet on its shoalest part, from which the Pilot tree is in line with Flat rock, and the fort flag-staff is in line with the north end of Pigeon island.

Para rock, having 5 fathoms, never breaks; it lies about $2\frac{1}{2}$ cables E. by N. from the Outer Kadda; from it Point de Galle lighthouse and east end of Elephant rock are in line; and the white mark is shut in with Watering point.

Buoys.—Outer Kadda rock is marked by a bell buoy, moored about 80 yards S.E. of the danger. In the event of the buoy breaking adrift, caution is necessary not to approach the rock too near, by keeping Ereminia point (a bluff point crowned with cocoa-nut trees, rather more than one mile to E.S.E. of Unawatti point) well open south of Unawatti point.

* The Pilot tree is very indistinct, being but little higher than the neighbouring trees; it has a flat top, and is on the nearest ridge. There is a more remarkable and somewhat similar tree on the second ridge which may be mistaken for the Pilot tree.

† Alut Ground, a small patch with 7 fathoms over it and 11 fathoms around, lies half a mile S.E. by E. $\frac{1}{4}$ E. from the Outer Kadda; with Edwards pillar bearing N.E. by E. $\frac{1}{4}$ E., and Point de Galle lighthouse N.W. $\frac{3}{4}$ N.

A buoy, spherical in shape and painted red, is moored in $7\frac{1}{2}$ fathoms, on the south west edge of Para rock shoal, with the following bearings:— Bayley's villa, Glosenburg N.N.E. $\frac{3}{4}$ E., Point de Galle lighthouse, N.W. $\frac{3}{4}$ N. As this buoy is placed mainly for the information of the pilots, vessels making the port should not proceed northward of the bell buoy marking the Outer Kadda rock, until a pilot has been received. This buoy is liable to break adrift.

WEST ENTRANCE is between the Inner Kadda and Mimattia rocks, and should not be attempted without a pilot.

ROCKS, WEST SIDE OF ENTRANCE.—**Mimattia rock** is half a cable in extent, has 17 feet on it, and breaks in bad weather during the south-west monsoon. It lies nearly mid-channel between the Inner Kadda and the islets off the lighthouse.

Polkatti rock has only 3 feet on it, and breaks; a *black* buoy is moored in $6\frac{3}{4}$ fathoms, about 30 yards E.S.E. from the rock.

Bellikatua rock has 15 feet on it, and forms with the inner Mata-Mada patch (distant $1\frac{1}{2}$ cables in an E. by N. direction) the narrowest part of the entrance to the west portion of the harbour. This rock breaks in bad weather during the south-west monsoon, and is marked by a small *black* conical buoy.

A *black* buoy, of spherical shape, lies E. $\frac{3}{4}$ N., distant 1·8 cables from the south-east extremity of Utrecht bastion. Inside, or westward of it foul ground extends towards the shore.

Kapera rock, about two cables northward of Bellikatua, has a shoal spot of 9 feet; a *black* buoy is moored in 5 fathoms about 70 yards E. by N. from the 9 feet shoal.*

Vellikoko, or Veluvaka reef, consists of two rocky patches, with from 3 to 9 feet water. The shoalest part of the north patch, with only 3 feet on it, is the danger on which the P. and O. steamer *Malabar* struck, causing her total loss, in May 1860; a *black* buoy is moored in 4 fathoms, bearing East 40 yards from this patch.

ROCKS EAST SIDE OF ENTRANCE.—Several groups of rocks lie between Watering point and the fair channel, the outer ones taking nearly a straight line in the direction of Point de Galle.

Imburinha rock, with 4 fathoms on it, never breaks. It is the south part of a rocky ridge of 5 fathoms, one cable in length north and south, bearing W. by N. $\frac{3}{4}$ N. $2\frac{1}{2}$ cables from Watering point, with a general depth of 7 fathoms between.

Deumba Dava rock has 12 feet on it, and breaks during the south-west monsoon; a *black* and *white vertically striped* buoy is placed a

* Kapera red buoy was S.E. $\frac{1}{2}$ E., distant half a cable, from the above position in June 1885.

short distance south-west of this patch, which lies about midway between Imburinha and Mata-Mada.

Kabira rocks are two patches, half a cable apart, in a north and south direction, with 5 and 6 fathoms between; they lie about 2 cables north-east from Deumba-Dava.

Ketti rock, on which the least water is 15 feet, lies with the belfry just open of Schwarte fort, and the Pilot's tree open its own breadth west of Alexander's house.

Bokolosava rock is well on the eastern shore of the bay, and distant one-quarter of a mile in a N. by E. direction from the nearest part of Watering point. The least water on it is $3\frac{1}{2}$ fathoms.

Mata-Mada rocks are the westernmost group, and make the eastern border of the fair channel into the harbour. These rocks form two distinct patches about three-quarters of a cable apart, and always break; a *red* buoy is moored in 6 fathoms, about 30 yards west from the inner and shoalest patch of 6 feet, from which the Roman Catholic church, on an eminence outside the fortifications, is just open of Schwarte fort, and the centre of Pigeon island is on with the north end of Flat rock.

Wara rocks always break, having only 3 feet on their shoalest part; they lie rather more than a cable north-east from Mata-Mada.

Avaria rock, with 4 fathoms on it, lies directly in the channel, midway between Kapera and Wara rocks, with the lighthouse open of Utrecht bastion, and the right extreme of Schwarte fort N. 58° W. distant 4 cables.

Kata rocks consist of a long ledge, extending in a south direction from near the west end of Gibbet island, towards Wara rocks. There are several detached patches on the ledge, with from 6 to 18 feet on them, and deep water around; a *red* buoy is moored in $5\frac{1}{4}$ fathoms about 80 yards westward of the 6 feet patch.

ROCKS IN HARBOUR.—**Tanna rock**, with $3\frac{1}{2}$ fathoms on it, lies nearly 2 cables due west from Gibbet island.

Gull rock is a small round rock, about 5 feet in diameter, 3 feet above the sea, and lying 2 cables north-east from the landing-place. There is a large iron ring on its summit, to which native vessels secure their stern hawsers.*

INLAND MARKS.—From Point de Galle the Haycock bears about N. by E. distant nearly 20 miles. It is a high conical mountain, in lat. $6^{\circ} 20' N.$, and is conspicuous from the offing, in sailing round the south-

* In June 1885, a wreck marked by one black and three red buoys, was lying about $1\frac{1}{2}$ cables, S. E. $\frac{1}{2}$ E. from Gull rock. (Navigating Lieutenant E. Fleet, R.N., H.M.S. *Briton*.)

west part of Ceylon between Colombo and Dondra head. About 9 miles eastward of the Haycock is a table-hill, with a knob or hummock on it, which is also visible from Point de Galle. Adam's peak, which bears about N. by E. $\frac{3}{4}$ E. 50 miles from Point de Galle, 7,379 feet high, is sometimes visible 90 miles off. The land westward of Point de Galle is generally low, with cocoa-nut trees fronting the sea, but to the eastward it is formed of several ridges of hills of various aspects.

SOUNDINGS.—The bank of soundings extends about 10 miles southward of Point de Galle, where ships may anchor with a stream or kedge, should the wind fail and the current be unfavourable. Gallehogalle bank, bearing S.W. by W. nearly 3 miles from Point de Galle, is a bank of 16 to 22 fathoms, with a depth seaward of 35 fathoms, and towards the land of from 24 to 26 fathoms. Not to lose ground, sailing ships may anchor in from 20 to 40 fathoms on any part of the bank of soundings between Point de Galle and Colombo; the bottom is often sand and gravel, but in some places rocky.

In coasting along from Point de Galle harbour to the north-westward, a ship ought not to come under 28 or 30 fathoms during the night, until she approach Káltura, for these depths are sometimes found within 3 or 4 miles of the shore. Between Káltura and Colombo the coast is safer, and may be approached to 15 or 16 fathoms in the day; but not so close during the night.

Outer Anchorage.—During the north-east monsoon the best anchorage off Point de Galle is in 16 fathoms, with the Pilot tree and lighthouse in line; and the rocks off Unawatti point on with Ereminia Galle. In the south-west monsoon, vessels seldom anchor in the road, but should they do so, the best temporary anchorage will be in the same depth of water, with the lighthouse bearing North-east, distant about $1\frac{1}{2}$ miles.*

TIDES.—It is high water, full and change, in Point de Galle harbour, at 2h.; springs rise about 2 feet. The tidal stream does not exercise any perceptible influence.

DIRECTIONS.—As the approaches to Point de Galle harbour are rendered dangerous by sunken reefs, it is necessary that vessels should obtain a pilot. In most cases the pilot canoe, with flag displayed (*white, red, white*, horizontal) awaits a ship beyond the limits of the off-lying dangers; but, as a vessel may have to seek a place of refuge when the heavy sea prevents a boat leaving the harbour, the following directions should be closely attended to. During the north-east

* In clear weather, the Haycock in line with Point de Galle lighthouse will lead into the outer roadstead.

monsoon (from December to March inclusive) the harbour is at all times accessible, and anchorage can be obtained with facility; for a sea breeze varying from S.S.E. to west, generally prevails during some part of each day. Early in the morning the wind is generally off the land from northward, and enables sailing vessels to leave the harbour. During the south-west monsoon (from April to November inclusive), though the wind frequently veers round even to northward of west, there is generally a heavy swell setting directly into the mouth of the harbour from the south-west; this sometimes occasions difficulty in bringing a vessel up in an anchorage so confined as to compel vessels to be moored by means of stern hawsers, which, if required, are supplied by the local authorities.

Approaching the harbour from westward.—By bringing Point de Galle lighthouse to bear E. by N., a vessel will pass clear to southward of Gindurá, the Whale, and Little Whale rocks. Both the Whale rocks are nearly in the same line of bearing, about W. $\frac{3}{8}$ N. from the lighthouse; the former being distant $2\frac{1}{2}$, and the latter $1\frac{1}{4}$ miles. Gindura rock lies a little more than $1\frac{1}{2}$ miles on a N. W. by W. $\frac{1}{2}$ W. bearing from the Whale. The rocky islets off the lighthouse may be approached in safety so long as the church in the fort,* or the Pilot tree, is kept to westward of the lighthouse; here the pilot's boat will generally be found.

Vessels requiring a pilot should heave to with the lighthouse bearing from N.E. to N.N.E., distant about one mile.

West Entrance.—To pass northward of Kadda rocks,† keep on an E. $\frac{1}{4}$ N. course, with Edwards pillar in line with the white tower on Watering point; this will lead between Mimattia rock and Inner Kadda rock. Proceed with this mark on, until the Roman Catholic church comes in line with the lighthouse; then steer about N.E. by E., or halfway between Glosenburg and Gravet point (the termination of the high land in the north-east corner of the harbour), until the flag-staff on Neptune bastion is in line with the lighthouse. Then haul up N. by E. $\frac{1}{4}$ E. through mid-channel between the *black* buoy of Polkatti and the *red* buoy of Mata-Mada. These buoys with the Bellikatua and Kapera buoys will then be the guides. When the lighthouse is shut in with Utrecht bastion, anchor in about 6 fathoms half a cable south-east from Kapera buoy.

East Entrance.—To pass southward of Kadda rocks, keep Pilot tree to westward of the lighthouse, until the *white* mark is well shut in with Watering point; the rocks off Unawatti point will then be open

* The church in the fort is not so conspicuous as was formerly the case, owing to the erection of new buildings; it may, however, be identified as being close to westward of a tower.

† Pilots do not, except in urgent cases, use the passage north of Kadda rocks in the south-west monsoon.

of the point. Then steer E. by S. until Pilot tree (the large mushroom-shaped tree on the summit of Mudlia hill) is on with the Kadda buoy, or just open eastward of all the fortifications. Run on then about 2 cables to north-east, hauling up for Pilot tree when it comes on with Polkatti *black* buoy. Stand on that line (about N. by W.) until the flag-staff and lighthouse are in line, then proceed as above directed, between the Polkatti and Mata-Mada buoys.

Steam ships, or sailing vessels with a fair wind, can enter or leave with the fort flag-staff and lighthouse in line, passing about one cable to the eastward of Para rock.

Gallehogalle Bank, having from 16 to 19 fathoms of water over it, with a coral bottom, extends about 3 cables north and south, by 4 cables east and west, and bears S.W. by W. distant 3 miles from Point de Galle lighthouse. Between Gallehogalle bank and the shore are depths of from 24 to 29 fathoms; and at $1\frac{1}{2}$ miles south-west of the bank are soundings of 39 and 40 fathoms.

UNAWATTI POINT, sometimes called Bellows point, the south-east headland of Point de Galle harbour, is steep, rocky, covered with trees, and conspicuous to a vessel approaching from the eastward. Edwards pillar, painted *white*, and 264 feet above the sea, is an excellent landmark, standing about three-quarters of a mile northward of the point.* When Unawatti point bears about north-west, distant 10 to 12 miles, it may be known by a clump of trees on the seaward slope of the hill; and, if the weather is clear, the flagstaff and lighthouse at Point de Galle will be seen about one point open to the westward.

Bellows rock.—There are several rocks off Unawatti point, on the outermost of which, called the Bellows, the sea always breaks, and very high in bad weather. Bellows rock bears S.S.E. $\frac{1}{2}$ E. from Unawatti point, distant about 6 cables, and S.E. $\frac{1}{2}$ E. $2\frac{6}{10}$ miles from Point de Galle lighthouse.

Luna Horowa rock.—This rock, the position of which is doubtful, appears to have a depth of 18 feet over it, and to bear S.E. $\frac{1}{4}$ S. about $1\frac{2}{3}$ miles from Unawatti point, and about $8\frac{1}{2}$ cables south from Ereminia Galle. Ereminia Galle point, covered with trees down to the water's edge, is the most projecting point eastward of Bellows rock, and lies about $1\frac{1}{4}$ miles E. by S. $\frac{3}{4}$ S. from Unawatti point.

SOUNDINGS.—The bank of soundings extends about 10 miles to the southward of Point de Galle, on which ships may anchor with a stream or

* To make Edwards pillar more conspicuous above the jungle, it is proposed to blacken the upper part.

ledge, should the wind fail and the current be unfavourable ; there is also the Gallehogalle bank already described available for the same purpose.

In Coasting from Point de Galle to the westward, a ship ought not to come under 26 or 28 fathoms during the night, until Káltura is approached, for these depths are sometimes found within 3 or 4 miles of the shore. Before October is advanced, strong westerly winds and leeward currents render it sometimes very difficult for a sailing vessel to get round the south-west part of Ceylon from Point de Galle to Colombo.

Outer anchorage in Point de Galle roads will be found in from 16 to 18 fathoms, soft bottom, with Galle flagstaff bearing N. by E. distant about $1\frac{1}{4}$ miles. In about 20 fathoms the bottom is foul and rocky. During the south-west monsoon this anchorage should not be used, as at that period Unawatti point and neighbourhood become a lee shore.*

DIRECTIONS.—Approaching Point de Galle roads from the southward and intending to anchor, Unawatti point when seen on a N.W. bearing, distant about 12 miles may be known by a clump of trees; and in clear weather Point de Galle flagstaff may be seen about two points open to the westward. The Haycock (a hill bearing that resemblance), situated inland about 20 miles to the northward in lat. $6^{\circ} 20' N.$, seen a little open to the westward of Point de Galle flagstaff N. by E. $\frac{1}{2}$ E., is a good mark, and on about the same bearing, the best anchorage will be found.

About 9 miles eastward from the Haycock is a table-shaped hill with a knob or hummock on it, also visible from Point de Galle roads. The land to the westward of Galle as viewed from the southward is generally low, with cocoa-nut trees fronting the sea, but to the eastward it is formed of several ridges of hills of various aspects.

THE SOUTH COAST of Ceylon† from Unawatti point eastward trends about E. by S., is low and woody with hills of moderate height inland, and so continues for about 12 miles to Belligam or Red bay. This part of the coast is steep and seldom approached under 30 fathoms.

Woody island, or Yaki-niga Duwa, small and covered with trees and fringed with coral reef, is situated about 9 miles eastward of Unawatti point, and a quarter of a mile from the shore. Close to the eastward of Woody island there is an opening in the reef affording anchorage for small coasting craft in from one to two fathoms, near the village of Goyapanná.

* In the southwest monsoon, ships ought to stand off and on Point de Galle, and not anchor while waiting for pilot or orders. (Remarks by Commander C. Murray Aynsley, H.M.S. *Assurance*, 1861.

† Chiefly from the remarks of Mr. T. H. Twynam, Master Attendant at Point de Galle in 1833.

A small rocky islet lies S.E. a quarter of a mile from Woody island, with which it is connected by coral reef.

About $5\frac{1}{2}$ miles eastward of Unawatti point, the reef which borders the coast projects more, and there is a passage through the reef leading to anchorage for boats in about 2 fathoms, off a village known locally as Kataloevi or Attadahowatti (Poloya Modere of the chart).

Vellivanni rock, $2\frac{3}{4}$ miles westward of Woody island, is only a few feet above water, and about a quarter of a mile from the shore, with depths of $3\frac{1}{2}$ and 5 fathoms close-to all round. On the beach about a mile westward of Vellivanni rock is a remarkable rock called Kotavanni or Kegalle Stone.

Rasa Muna hill, or Rasa Muna Kanda hill, on the west entrance point of Belligam bay, has some red cliffs, and bears from Woody island W. by S. distant 2 miles. The land between is rugged, of moderate height, and covered with jungle, with an occasional clump of cocoa-nut trees, and lined with coral reef, having from 5 to 9 fathoms close-to.

BELLIGAM or RED BAY,* affording good anchorage in 5 to 6 fathoms, is about $1\frac{1}{2}$ miles wide at its entrance, and running in for the same distance takes a semicircular shape. There are two small islands in the north-west part of the bay known as Gan and Pigeon islands. Gan island lies close to the beach, to which it is connected at low-water, off the village of Belligam. Pigeon island, of circular shape and about half a cable in extent, bears East, distant $4\frac{1}{2}$ cables from Gan island.

A reef projects from Rasa Muna hill point, on the west side of Belligam bay, for about 3 cables in an E.S.E. direction, and fringes the coast line of the west part of the bay as far as Gan island.

Belligam point is situated about $3\frac{1}{2}$ cables N.E. by N. of Rasa Muna hill point, and there is a similar projection between.

Ruane or Ruana rock is small and quoin-shaped, and bears from Belligam point E. $\frac{3}{4}$ N., distant $2\frac{3}{4}$ cables.

Belligam village with a custom house and rest house at its southern end, extends along the shore of the bay near Gan island, and at a distance of about half a mile northward of Belligam point.

Paas rock having 3 fathoms on it, lies $4\frac{1}{2}$ cables E.S.E. from Rasa Muna hill point, and Kadda rock $9\frac{1}{2}$ cables in the same line of direction. Between these two rocks lies the entrance channel into Belligam bay.

Godahalut rock, with one fathom over it, lies $4\frac{1}{2}$ cables S. $\frac{1}{2}$ E. from Rasa Muna hill point and is the south-western danger of Belligam bay.

To enter, keep the high cocoa-nut trees on the point inside Woody island well open, until Ruane rock is on with Gan island, when haul up

* See Plan of Belligam bay, scale $m = 3$ inches, on Admiralty chart No. 813.

for Virumba rock, elevated about 10 feet above the water, and situated in the northern part of the bay, this will lead between Paas rock and Kadda rock; an anchorage may be picked up about 2 cables eastward of Ruane rock in 5 to 6 fathoms, sandy bottom. It is advisable not to stand too far to the northward of Ruane rock, on account of the foul ground extending about 3 cables south-east of Gan island, and between that island and Pigeon island.

TIDES.—It is high water full and change, in Belligam bay at about 2h. 20m.; springs rise $2\frac{1}{4}$ feet.

Mirissi village is situated on the shore of a shallow bight in the south-east part of Belligam bay; close to the northward of it are some remarkable red cliffs.

Mirissi point, the east point of Belligam bay, bears from Rasa Muna hill point E. by S. $\frac{1}{2}$ S., distant $1\frac{1}{2}$ miles. It is the north-west extreme of a rocky peninsula, presenting a range of cliffs to the sea of about three-quarters of a mile in extent, off the centre of which are several rocks above water. A rocky ledge about $1\frac{1}{2}$ cables in extent, is situated 2 cables west of Mirissi point, the channel between having 6 fathoms of water.

Deumbahullet rock, having over it 9 feet of water, bears W. $\frac{1}{2}$ N. from Mirissi point, distant $3\frac{1}{2}$ cables.

THE COAST between Mirissi point of Belligam bay and Mátura trends E. $\frac{1}{2}$ S. for about 7 miles, is moderately elevated, densely wooded, and the water deep, having in some places 40 fathoms within 2 miles of the shore.

Madumora or Madamura bank, having 3 fathoms on it and 8 fathoms outside close to, lies about a mile S. $\frac{1}{2}$ W. of Mátura river entrance, and three-quarters of a mile from the shore. It bears from Pigeon island S.S.W. rather more than a mile, and from Dondra head W. $\frac{1}{2}$ N., distant $2\frac{1}{2}$ miles.

Madumora bank and all other dangers off Mátura and Dondra head may be avoided by keeping the highest part of the high land of Mirissi point well open of the land to the eastward of it.

MÁTURA, a considerable town with a fort, is the station of an assistant government agent. Situated in a bight westward of Dondra head, from which it bears N.W. by W. distant $2\frac{3}{4}$ miles, it is only conspicuous from seaward between the bearings of N.N.W. and N.E. Its position may be discerned by Pigeon or Mátura island, which resembles a haycock, and lies near the beach directly off it. Boats find shelter under Pigeon island, and the surf being generally high, canoes are used for passing to the mainland.

Mátura river, the entrance of which is about half a mile westward of Mátura fort, has several dangerous sunken rocks at its entrance, from which there is also a strong outset, rendering it necessary to employ natives as pilots if desiring to enter. Wood and fresh water may be procured in the river.

Anchorage during the north-east moonsoon may be obtained abreast the town of Mátura, and 2 miles from the shore in from 20 to 22 fathoms, with the Red cliffs bearing N.N.E. $\frac{1}{2}$ E., bottom of sand, shells, and ooze; under 20 fathoms the bottom is generally foul.

The coast between Mátura and Dondra head curves gradually to the southward, forming a bight, and about half way between are some red cliffs resembling those of Belligam bay, but more conspicuous, especially during the afternoon.

DONDRA HEAD, the southernmost point of Ceylon, is low, with a grove of tall cocoa-nut trees on its extremity, by which it may be known. About 18 miles inland and bearing north from Dondra head is a hill about 2,000 feet high, resembling a saddle when seen from the south-east. The land along this part of the coast is generally of moderate height, formed of a diversity of hills, which become more elevated in the interior.

A reef projects from Dondra head about a mile to the westward, having on it 9 and 10 feet of water, upon which the sea breaks heavily, but directly southward of the headland the water is deep.

Gándura point bears from the east point of Dondra head E. by N. $\frac{1}{4}$ N. distant $1\frac{1}{2}$ miles. The coast here is high and rocky, and lined with a reef. A rock having over it 3 fathoms lies close to Gándura point on the south side. The village of Gándura lies to the northward of the point at the bottom of a small cove, about a quarter of a mile in depth and $1\frac{1}{2}$ cables wide, having anchorage in 3 to 6 fathoms, sand and ooze, but exposed to the swell in the south-west monsoon.

Kapperawelli point bears from Gándura point N.E. by E. $\frac{1}{2}$ E. distant $1\frac{1}{2}$ miles; the coast between forming Gándura or Galieo bay is high and rocky and lined with reef. Close to the shore about half way between Kapperawelli and Gándura points are some rocky islets termed the Hienia rocks. Nuroní cove, having a sand beach and cocoa-nut trees, interrupts the rocky coast line of Gándura bay for about half a mile. Linea rocks or islets extend nearly half a mile in an E.N.E. direction from Kapperawelli point, inside of which, in a sandy bight, is the village of Kotagoddi.

Etawa or Etala reef, nearly half a mile in length in an E.N.E. and W.S.W. direction, bears from the east end of Kapperawelli point E. $\frac{1}{2}$ N., distant three-quarters of a mile, and is about half a mile from the shore.

Bambrí rock, half a mile eastward of Etala reef, is above water and connected by a reef with the shore.

Nilewelli point bears from Kapperawelli point E. by N. distant $4\frac{1}{2}$ miles, the coast between being of moderate height, covered with jungle with an occasional sandy bight and plantation of cocoa-nut trees. Nilewelli point is rocky, of moderate height, nearly insulated, and has a remarkable clump of cocoa-nut trees giving it the appearance of a table island when seen from the east or westward. It is connected with the mainland by a strip of sand over which the sea breaks. About a mile northward of Nilewelli point, and half a mile inland, is a conspicuous pagoda coloured white.

Polonha point bears from Nilewelli point N.E. $\frac{1}{2}$ E. distant one mile. Nilewelli bay, between Polonha and Nilewelli points, has high and rocky shores, but at the bottom of the bay is a sandy beach, lined by a reef, which extends half a mile from the shore.

Nilewelli village stands in a small bight on the west side of Nilewelli bay; and off the village is the best anchorage, in from 4 to 10 fathoms sand, but the bank is steep-to, and the anchorage confined.

Vessels anchoring here should take care to shut in Tangalle fort (to the eastward) by Polonha point, as outside this mark the ground is foul.

Dekwelli or Deekwelli point is situated about one mile westward of Nilewelli point; the small bay and village of the same name, with a rest house and plantation of cocoa-nut trees near the beach, lies between Dekwelli and Nilewelli points, but the fringing shore reef extending across the mouth of the bay renders it inaccessible.

MAHAWELLI POINT, bearing from Polonha point N.E. $\frac{3}{4}$ N. distant $1\frac{1}{2}$ miles, is high, steep, and rocky, the coast between forming a bight at the bottom of which is Sureya Tree bay, small and sandy, where the coasting craft anchor in 3 fathoms, sand, close to the beach.

Mahawelli bay, having anchorage in 4 to 7 fathoms in its south-west part, lies immediately northward of Mahawelli point. Mahawelli rocks, small, and nearly awash, bear E. by N. $\frac{3}{4}$ N. from Mahawelli point; close to all round them is a depth of 8 fathoms.

Ūnaeria rocks or islets, nearly half a mile from the shore and three-quarters of a mile E. by N. $\frac{3}{4}$ N. of Mahawelli point, have 5 fathoms of water inside or to the northward of them and from 7 to 9 fathoms close to on the outside.

The passage into Mahawelli bay, about half a mile wide in 9 and 10 fathoms, lies between the Ūnaeria and Mahawelli rocks, keeping nearer to the Mahawelli rocks to avoid a patch called Middle rocks, situated about $1\frac{1}{2}$ cables W.S.W. of Ūnaeria rocks.

TANGALLE POINT forms a gradual hill slope towards the sea and bears N E. $\frac{1}{2}$ E. $4\frac{3}{4}$ miles from Polonha point; the coast between being of moderate height and generally rocky. A square fort and Cutcherry stand on its summit, by which it may be recognised from seaward. A reef extends three-quarters of a mile eastward from Tangalle point.

Tangalle rocks, above water and steep-to, bear from Tangalle point E. $\frac{1}{2}$ S. distant one mile. Between Tangalle rocks and the reef off Tangalle point is a passage having 5 fathoms of water, but obstructed by Kadul rock having 10 feet of water over it, which is near the middle of the channel, as well as Ma rock having 16 feet.

Tangalle bay, of considerable extent east and west but of no great depth, lies eastward of Tangalle point, and affords indifferent anchorage in 5 to 6 fathoms, sand, the bottom in Tangalle bay being generally foul, and the anchorage exposed to the swell of the south-west monsoon. A reef commences about a mile eastward of Tangalle point, and lines the eastern side of the bay to a distance of about half a mile from the shore. The west side of the bay is low with cocoa-nut plantations, amongst which is the town of Tangalle. The custom-house is on the west side of the bay, and the best landing place is near it.

To enter Tangalle bay.—Boats with flags are generally stationed on Kadul and Ma rocks when vessels are entering or leaving the bay. A stranger should pass eastward of Tangalle rocks and stand to the north-east until a small white pagoda (half a mile N.W. of the fort) is in one with the high cocoanut trees on the south-west bank of the outlet of Kunkalle river, when anchor in 5 to 6 fathoms with Tangalle rocks bearing from S. by E. to S.E. by S.

Rakova point, sloping and barren and having a reef projecting half a mile from it to the southward, is the east point of Tangalle bay, and bears from Tangalle point E. by N. $\frac{3}{4}$ N. distant $3\frac{1}{2}$ miles. Eastward of Rakova point the coast forms a bight lined with coral reef, having on its eastern side the village of Kahandawa with several clumps of cocoanut trees.

Kahandawa point, forming the eastern extremity of this bight, is sandy and of moderate height; it bears from Rakova point N.E. by E. $\frac{1}{2}$ E. distant $2\frac{1}{2}$ miles.

Kahandawa rocks of which there are two, bear from each other N.W. by W. and S.E. by E. distant a quarter of a mile. The northern or inside rock situated on the edge of the reef is small and above water and bears from Kahandawa point S.W. distant three-quarter of a mile. The outer Kahandawa rock is just below the sea surface, with other rocks around it, and bears from Rakova point E. by N. $\frac{1}{4}$ N. distant $2\frac{1}{2}$ miles.

KALAMATTA POINT, high and rocky, with a chain of rocky islets lying south-east of it bears from Kahandawa point E. by N. $\frac{1}{4}$ N. distant $2\frac{1}{2}$ miles, the coast between being sandy and barren.

Levay rock, very little under water, bears from Kalamatta point S.W. $\frac{1}{4}$ W. distant nearly a mile, and is about half a mile from the shore.

Watta rock or islet, the outermost of the chain of islets off Kalamatta point, bears from that point S.E. distant about 6 cables. Rocks project south-east of Watta rock for about a quarter of a mile.

Kalamatta rocks, nearly even with the water's edge and three-eighths of a mile northward of Watta rock, form a rocky patch, bearing E. $\frac{1}{2}$ N. distant a quarter of a mile of Kalamatta point.

Anchorage.—Between Kalamatta rocks and the chain of islets of which Watta rock is the southern, there is anchorage in from 5 to 7 fathoms, sand; and between Kalamatta rocks and the shore to the northward, anchorage in 4 to 6 fathoms, sand and ooze, off the small village of Kalamatta. The ground to the eastward of Kalamatta rocks is foul, the only landing place being close to the northward of Kalamatta point, a reef lining the coast projects about 3 cables from the shore at $2\frac{1}{2}$ miles distance eastward of Kalamatta point, and forms the shallow bay of Kalamatta.

Ulandhe point, the east point of Kalamatta bay, is high, sandy and barren, and bears from Kalamatta point E. by N. $\frac{1}{2}$ N. distant $2\frac{1}{2}$ miles.

Rattan or Rattana point consists of red cliffs of moderate height, and bears E.N.E. $\frac{3}{4}$ of a mile from Ulandhe point. Some rocks above water lie close off Rattan and Ulandhe points, inside the reef, which here projects half a mile from the shore.

Godaway point is high, rocky, and barren, and bears E. by N. $\frac{1}{2}$ N. from Rattana point distant 4 miles. The coast between Godaway and Rattana points is low, sterile and lined with reef, except about midway between the two points, where the river Waluwi disembogues, and there are a few clumps of cocoanut trees.

Ibha rock is dangerous, and has less than six feet of water over it; it bears from Godaway point S.S.E. $\frac{1}{2}$ E. distant one mile, and there is from 6 to 7 fathoms water between the rock and the shore.

Nehindi rock, about a mile from the shore, is nearly level with the water's edge, and steep to all round. From it Hambantotti tower bears S.W. by W. $\frac{1}{4}$ W., distant $3\frac{1}{4}$ miles. Inside Nehindi rock, is a clear channel, carrying 5 fathoms near the shore, and from 8 to 9 fathoms, rock. Between Nehindi and Ibha rocks are depths of 9 and 10 fathoms.

Caution.—From the form of the land no good marks can be given to clear the Ibha and Nehindi rocks, which do not always break; a ship should not come into less than 20 fathoms when approaching this part of the coast, which depth will be found about 2 miles outside, or southward of them.

HAMBANTOTTI POINT, high, sandy, and barren, bears from Godaway point E. by N., distant 5 miles; on its summit stands a round tower and several houses. To the north-east of Hambantotti point is Hambantotti bay with anchorage in it from 4 to 7 fathoms, sand and ooze. The town of Hambantotti is at the bottom of the bay near Hambantotti point. There is an Assistant Government agent here, and special port rules for the anchorage.

Anchorage.—In the north-east monsoon vessels calling here should anchor to the eastward of Hambantotti point in 8 to 9 fathoms, sand; but in the south-west monsoon they should proceed farther under the lee of the point, into the bay, so as to avoid the swell.* All dangers in Hambantotti bay are above water and visible. The government coasting steamer calls here twice a month.

Levay point, forming the N.E. point of Hambantotti bay, bears from Hambantotti point N.E. $\frac{1}{2}$ N., distant $1\frac{1}{2}$ miles.

Patteraja point, of moderate height, sandy and barren, bears from Hambantotti point N.E. by E. $\frac{3}{4}$ E., distant $6\frac{1}{2}$ miles, the coast between being of the same sandy barren nature and lined with a reef.

DORÁVA POINT,† called also Mago point, is flat, rocky, of moderate height, and bears from Patteraja point E. by N. $\frac{3}{4}$ N., distant 6 miles, the coast between continuing its sandy barren nature. About $1\frac{1}{2}$ miles to the westward is a small river‡ near the village of Mahagām, the mouth of which is closed by a rocky bar.

Lansiya rock, small and above water, bears from Doráva point S. by W. distant about 5 cables; rocky patches extending between the rock and the shore.

Doráva rock, having over it 3 fathoms of water with from 9 to 11 fathoms all round, bears from Doráva point S.E. distant nearly three-quarters of a mile, and from Lansiya rock E. $\frac{1}{2}$ S., distant half a mile.

To clear Doráva rock vessels should not come into less than 13 fathoms till the highest peak (1,972 feet) of the range of hills nearest this part of the coast (Kattregammi hills) comes in line with Kirindi point.

KIRINDI POINT, rocky, rugged, of moderate height, having several large rocks on its summit, near which a temporary flagstaff is sometimes erected, bears from Doráva point N.E. $\frac{1}{2}$ N., distant $1\frac{1}{2}$ miles. Off

* A good position is, with the Martello tower S.W. by W. $\frac{1}{4}$ W., and Rocky point S.S.W. $\frac{1}{4}$ W., in $5\frac{1}{2}$ fathoms. With these bearings on, drop anchor at once (Master Attendant, Colombo, August 1886).

† See Admiralty chart No. 2815 of the S.E. coast of Ceylon from Kirindi to Julius Nave point, including the Basses rocks; scale, m = one inch.

‡ Termed Kirindi river in Horsburgh's Directory, eighth edition, vol. 1, page 557, which also states that about 8 miles S. by E. $\frac{1}{4}$ E. from Doráva point breakers were said to exist.

shore from Kirindi point, several detached rocks, both above and under water extend to a distance of nearly half a mile, the largest of which is termed the Korha rock. To the northward of Kirindi point is a small bay, in which small craft anchor in from 3 to $3\frac{1}{2}$ fathoms, off the salt stores on the beach, but this anchorage is difficult of access.

TIDES.—It is high water full and change in Kirindi bay at about 3h. 30m; springs rise 2 feet.

Anchorage.*—The best position in which to anchor in Kirindi bay, is with the north end of the salt stores on the beach open of the high part of the point, but not so far open as to be on with the outer detached rocks; the high rock on Kirindi point will then bear W.N.W to N.W., and the outer detached rock off Kirindi point from N.W. to N. $\frac{1}{2}$ W., and the depth will be from 9 to 10 fathoms. To the north-east of this the ground is foul.

Paltopani point† or Pultopani, is low and sandy, and bears from Kirindi point N.E. by E., distant $2\frac{1}{2}$ miles, the coast between being barren, sandy, and fringed with reef. About half a mile N.N.E. of Paltopani point the coast forms a bight, and on the summit of the rising ground near the beach stands Paltopani fort.

Levay point bears N.E. by E., distant $1\frac{1}{2}$ miles from Paltopani point, and has foul ground extending from it for a third of a mile to the south-east.

GREAT BASSES is a dangerous reef of red sand-stone rocks, 6 miles distant from Levay point, three quarters of a mile long, in a N.E. $\frac{1}{2}$ E. and S.W. $\frac{1}{2}$ W. direction, by a quarter of a mile broad, and about 8 feet above the surface of the ocean.‡ The reef is continuous, portions only showing here and there in the wash of the sea; the north-eastern part is the highest and broadest, forming a rocky wedge-shaped ledge 70 yards long, N.E. and S.W., by about 30 yards broad, and from 6 to 8 feet above high water.

Great Basses reef has deep water to within half a mile of it on all sides; but on the western side, about one mile from the reef, there is a patch of 8 fathoms; and on the eastern side at $1\frac{1}{2}$ miles, is another of 5 fathoms, with deeper water between it and the reef.

LIGHT.—On the north-east or highest part of Great Basses reef, is a granite light-tower, 127 feet in height, from which is exhibited at an elevation of 110 feet above the sea, a *revolving red* light, dioptric, and of

* See plan of Kirindi road, scale $m=3$ inches, on Admiralty chart No. 813.

† The Paltopani point of Horsburgh's Directory, eighth edition, vol. 1, page 557, appears to be the Levay point of Admiralty charts No. 2815 and 813.

‡ The description of Great Basses reefs, &c., is compiled from the remarks of Captain W. J. S. Pullen, H.M.S. *Cyclops*, 1860.

the first order, which attains its greatest brilliancy *every forty-five seconds*, and in clear weather should be seen from a distance of 16 miles.

In thick or foggy weather a bell is sounded *once every fifteen seconds*.

The roof of the lantern is conical, a gallery surrounds the tower at a distance of 30 feet from the base, and a second gallery immediately under the lantern, which peculiarities serve to distinguish it from the Little Basses light-tower (which has a domed roof and two galleries 12 feet apart near the lantern).

From the light-tower Kattregammi peak bears N.W. by N.; Elephant hill North a little westerly; Chimney hill N.N.E.; and Nipple peak N. $\frac{3}{4}$ E. This latter line of direction also passes a little eastward of Little Elephant hill, which is round topped, of 105 feet elevation, and close to the beach, on the west point of the bay next west of Potana.

LITTLE BASSES.—The light-tower built on this reef bears N.E. $\frac{1}{4}$ E. (N. $49^{\circ} 45'$ E. true), distant 20 miles from the light tower on the Great Basses. The reef is only about 2 feet above water, and appears to consist of large boulders, which even by daylight are scarcely perceptible till close up to them. The extent of that portion usually shown by breakers is not more than a quarter of a mile across, about E. by S. $\frac{1}{2}$ S. and W. by N. $\frac{1}{2}$ N.; but W.S.W. from its western part are many sunken patches, breaking so much in heavy weather, that occasionally the sea covered with surf for a distance of $1\frac{1}{2}$ miles.

The Little Basses is not more than $4\frac{1}{2}$ miles from the nearest part of Ceylon; and on its northern side are several patches of shoal water, one of which, carrying the least water, 3 fathoms, bears N. by W. distant $1\frac{1}{2}$ miles from the Little Basses light-tower. This patch is of limited extent, having $3\frac{1}{2}$ and 4 fathoms water close to on its southern and western sides, and 6 and 7 to the northward and eastward. It is concluded to be the shoal on which the *Atlas* (one of the fleet under convoy of H.M.S. *Dædalus*) first grazed over on the morning of the 2nd July 1813.

Atlas reef, bearing N.E. $\frac{3}{4}$ N. $1\frac{1}{2}$ miles nearly from Little Basses, is another patch of 3 fathoms, with 4 and 5 fathoms water close around it, and probably the reef over which the *Atlas* grazed the second time.

LIGHT.—On the centre of Little Basses reef is a granite light-tower, from which is exhibited at an elevation of 110 feet above the sea, a *flashing white* light, dioptric, and of the first order, which shows *two flashes* in quick succession *every minute*, at intervals of *fifteen* and *forty-five* seconds, and should be visible in clear weather from a distance of 16 miles.

In thick or foggy weather a bell is sounded *twice* in quick succession every half minute.

The lantern has a domed roof, and two galleries, 12 feet apart, surround the light-tower near the top, from which it may be distinguished from the

Great Basses light-tower, which has a conical roof and one gallery near the lantern, and another, 30 feet from the base of the tower.

The following are the bearings from Little Basses light-tower:—Chimney peak, N.W.; Nipple peak, N.W. by W. $\frac{1}{2}$ W.; Elephant hill, W. $\frac{3}{4}$ S.; and Kattregammi peak, W. $\frac{1}{4}$ S. By seeing either of these objects on the bearings stated against it, the mariner will know that Little Basses reef is in the same direction. The reef should always be approached with caution, and a vessel should never attempt to pass between it and the Ceylon shore.

THE SOUTH-EAST COAST of Ceylon between Doráva and Julius Nave points, a space of 30 miles, trends nearly N.E. and S.W., with ranges of high mountains inland, often obscured, however, by the hazy state of the atmosphere, said to be peculiar to this part of the island, particularly during the south-west monsoon. Near the coast inside the line of the Basses, are several remarkable hills which form admirable landmarks, during daylight and fine weather, for navigating in the vicinity of the Basses.

The shore is comparatively low and barren, fringed with a belt of sand, but without any marked features; the points are generally rounded and sandy, rising to elevations of about 100 feet. Off the pitch of all the points are rocky patches, extending in some cases to the distance of a quarter of a mile. Along the whole line of coast the surf breaks heavily on the beach, the first roller rising at the average distance of a cable's length from the shore.

Kattregammi hill.—The most prominent land seen when approaching the Basses from the westward is the Kattregammi range of hills, the nearest and highest of which is between 7 and 8 miles distant from the sea. These hills are sometimes conspicuous both from the eastward and westward, when others nearer to the sea are hardly discernible. Their summit presents an irregular ridge, the north-east peak of which (1,972 feet) is the highest.

Elephant hill, the next height to the eastward, is conspicuous from standing alone on the low land near the shore, and bearing a remarkable resemblance to the animal from which it is named. It is 2 miles from the beach, bare and destitute of trees on its summit, which is 480 feet above the sea.

Little Elephant hill, in shape resembling a haycock, stands on the extreme point forming the western horn of Elephant bay; its elevation is 105 feet, and from it Elephant hill bears N.W. $\frac{1}{2}$ N. 2 miles. Off this point, at the distance of one third of a mile in an E.S.E. direction, is a rock just above water.

Anadowi point, next west of Little Elephant, may be known by its off-lying rocks. The outer one, which is about 4 feet above the sea level, is distant three-eighths of a mile from the shore, and is steep-to on the outside, having 7 fathoms within a cable's length.

Nipple hill bears from Elephant hill N. by E. $\frac{3}{4}$ E. distant about 9 miles. Rendered conspicuous by its superior elevation, 903 feet above the sea, this peak is also distinguished by a flattened summit, with two lumps (one at each end) in a direction about W.S.W. and E.N.E., from which it derives its name; the western of these nipples is the higher. This hill may also be known by a remarkable cone W.S.W. of it, generally distinguishable, but more so from the eastward, although only 520 feet above the sea.

Chimney Hill, next in succession eastward, is of use for ascertaining a vessel's position. It is $4\frac{1}{2}$ miles from the nearest beach, 445 feet above the sea, and conspicuous, being the highest part of a low range which takes an east and west direction; it appears to be separated from the western part of the range, and resembles a chimney. From the Great Basses it is not easily seen, being sometimes concealed by the haze which generally hangs over the land, especially in the south-west monsoon.

Potana point is rather more than one third the distance along the coast, between Elephant and Chimney hills. The station made during the survey of 1860 on this point, a sandhill 105 feet above the sea, bears from Great Basses light-tower N. $24^{\circ} 35'$ E. (true), distant $12\frac{3}{4}$ miles; and from Little Basses, light-tower S. $79^{\circ} 10'$ W. (true), distant 10 miles. Potana point forms the deepest bay on this coast, but a heavy sea setting into it, throws the surf up to its innermost south-west angle. Off Potana point, and also westward of it, the shore is beset with detached rocks for about a mile out, on which the sea is always breaking, thus presenting the characteristic feature of the coast, viz., a rocky sandy shore, wherever there is any tendency to a point.

Off Potana point is the only anchorage inshore, that was used or found available for H.M.S. *Cyclops* in the course of the survey. She anchored in from 5 to 6 fathoms water, with the point bearing about W.S.W.

DANGERS WITHIN the BASSES.—Elephant reef is $1\frac{1}{2}$ miles in length, N.E. $\frac{1}{2}$ E. and S.W. $\frac{1}{2}$ W., and a quarter of a mile broad. The north-east breaker on it is 4 miles from Little Elephant hill, which is in line with Elephant hill. The south-west extremity is S.E. $\frac{1}{2}$ E., seven-eighths of a mile from the detached rocks off Anadowi point. Between, is a clear channel, carrying 8 to 9 fathoms.

Potana reef, the centre of which lies E. by N. $\frac{3}{4}$ N. $1\frac{1}{8}$ miles from the north-east end of Elephant reef, and N.N.E. from the Great Basses

light-tower, is a rocky patch about half a mile broad and nearly square, on which the sea always breaks. No broken water was seen between it and Elephant reef; there may be deep water between them, but the space has not been examined, and should not be attempted.

Cyclops reef is a narrow, sandy ridge, with patches of rock and boulders, having only 2 fathoms on it in some places. It is $3\frac{3}{4}$ miles long, E. by N. $\frac{1}{2}$ N., and W. by S. $\frac{1}{2}$ S., and from a quarter, to half a mile in breadth.

From its west end, in 3 fathoms, Potana point bears North 2 miles; and from its eastern end, in 4 fathoms, Chimney hill bears N. $\frac{1}{4}$ W., the shore in that direction being $3\frac{1}{2}$ miles distant. This reef is dangerous in consequence of the sea breaking only occasionally on it, and from its having deep water close to on each side.

There is a channel between the western extreme of Cyclops reef and Potana reef, 2 miles wide, with from 8 to 10 fathoms, frequently used by the *Cyclops* in passing between her anchorage at Potana and Great Basses. Chimney hill, on with Potana point, leads through in mid channel.

Dædalus reef is a small narrow patch of 15 feet, lying N.N.W. $3\frac{1}{4}$ miles from Little Basses, and $1\frac{1}{2}$ miles off shore, with Chimney hill bearing N.W. by W. The *Cyclops* struck heavily on this shoal, but from its being so narrow, was soon off, and could not again find the exact place with the lead. The depth was, therefore, determined by the ship's draught of water. From Horsburgh's description this is the shoal on which the *Dædalus* was wrecked, for it states "she fell over and went down," the only spot where this could happen from the deep water close around it. The *Cyclops* had 7 fathoms as soon as she was off.

Inside passage.—There is a deep channel within the before-mentioned dangers that may be taken, but only in case of necessity, by keeping about midway between the Elephant, Potana, and Cyclops shoals on one hand, and the mainland on the other, or a mile off shore. The *Dædalus* reef may be passed on either side. If passing inside from the westward, keep about a mile from the shore till abreast Julius Nave point, then edge farther from it; if passing outside, keep about half way between the Little Basses and the shore; but no stranger should attempt the inner passage unless in case of sheer necessity, as the coast does not permit of any leading or back mark being given.

A vessel bound westward, after clearing the Little Basses, and certain of daylight, if keeping a good look-out, may pass inside the Great Basses; she may also do the same going to the north-eastward, but when clear of the Great Basses she must haul well to the eastward to pass outside the Little Basses, the light-tower marking which will be a good guide.

The coast is clear as far as Galle and may be approached to 2 miles distance, but only in daylight, as it is impossible to judge of distances accurately by night.*

CURRENTS in the vicinity of the Great and Little Basses reefs are remarkable for their rapidity and eccentricity. In a line between the two reefs, that is, about 6 miles off shore, the current, during the south-west monsoon, sets along the coast to the north-east, at the rate of one to 2 miles per hour, only diverging from this course when within the influence of the broken ground of the reefs. The rate influenced by the strength of the wind is most irregular; the best way, therefore, of avoiding danger is to give the rocks a wide berth, although it may incur a loss of time.

Between Point de Galle and the Basses the current sets along the line of coast, the rates varying at different times without any apparent cause from 1 to 4 knots; but to the northward of the Little Basses, close in on the eastern shore, a decided southerly set was experienced during the south-west monsoon by the *Cyclops*, at the rate of nearly a mile an hour, which increased to 2 knots near Trincomali. While lying within Little Basses, this southerly set to windward was occasionally felt, the wind blowing strong enough at the time to keep the ship broadside on; but this seldom lasted more than a couple of hours. At Great Basses it was never felt, and only occasionally as far west as the anchorage off Potana point; the greatest strength found at Little Basses was three-quarters of a knot.† The strongest wind and worst sea during the north-east monsoon are to be met with off the Basses, but less close to them than in the offing, and a few miles to the northward of the Little Basses the weather becomes finer.‡

Between Dondra head and Tangalle there is often a strong indraft when the current is setting strong to the westward.

The following table showing the winds and currents at Little Basses rocks has been compiled from a memorandum (April 1869) by Mr. John Buchanan, master of the light-vessel, which marked the position previous to the erection of the light-tower.

Month.	Wind and Weather.	Current.		REMARKS.
		Directions.	Force, knots.	
January	Strong, steady N.E. monsoon.	S.S.W.	2 to 3½	Sea cross and rough. Steam vessels steering N.N.E. have remained in sight for 2 hours. Ships bound to N.E. should avoid S.E. coast of Ceylon this month.

* Commander C. Murray Aynsley, H.M.S. *Assurance*, remarks, 1861, that during the north-east monsoon a vessel can anchor anywhere along the south coast of Ceylon, and that the currents are of greater strength in the offing than close in shore.

† H.M.S. *Cyclops*, 1860.

‡ Commander C. Murray Aynsley, H.M.S. *Assurance*, 1861.

Month.	Wind and Weather.	Current.		REMARKS.
		Directions.	Force, knots.	
February	N.E. monsoon, lighter towards end of month.	S.S.W., but sometimes slackens.	2 - -	At the end of February land and sea breezes commence, and there are regular tides at springs.
March	Land and sea breezes prevail.	Generally S.S.W., but variable at times.	Weak -	Passage up and down coast easy this month, which is fine. Temperature 87° in the shade.
April	Sometimes N.E. sometimes S.W.	Very little, but occasionally strong to S.W.	Weak. If to S.W. strong.	Gloomy weather; occasional showers, thunder and lightning. Intense blackness over the land.
May	S.W. monsoon sets in between 1st and 20th.	N.E.	1 to 3 -	Much rain, thunder, and lightning. After S.W. monsoon sets in no rain until October.
June	S.W. monsoon begins at 10 a.m., increases to a gale by noon, so continues until 4 p.m. and decreases towards sunset. If it continues after sunset, moderates at 10 p.m.; strong breeze only at night.	N.N.E.*	1 to 3 -	As sun passes southward of the equator, regular S.W. monsoon ceases on south coast of Ceylon, wind becomes variable, land and sea breezes setting in, with intervening calm.
July				
August				
September				
October	Regular land and sea breezes.	Towards the end of the month S.S.W.	5 - -	Direction of current changes about middle of month, and runs to south-west until middle of March.
November	Land and sea breezes in early part; N.E. monsoon sets in strong towards end of month.	S.S.W.	4-5†	Rainy, with thunder and lightning.
December	N.E. - - -	S.S.W.	5 - -	Current setting to the southward attains its greatest strength. In December most difficult to proceed to the northward along the south-east coast of Ceylon.

The period during which ships can most easily proceed north, is that between February 15th and November 15th; in November, December, and January it will be found difficult, except in full-powered steam vessels. The currents, from the middle of November, or during the north-east monsoon, set S.S.W. out of the bay of Bengal for about 5 months; thus a steamer, steering N.N.E., has not only to oppose a 3-knot current, but also has the wind against her. During the remaining seven months the

* A remarkable circumstance occurs with regard to current during the south-west monsoon. After running 3 knots to the N.E. for ten days, suddenly it slackens, and runs from 2 to 3½ knots S.W. or out of the bay of Bengal, lasting sometimes one day, at others a week; these changes happen at all phases of the moon, and appear to obey no recognised law. (From Report of Mr Buchanan, master of the former Little Basses light vessel, April 1869)

† In November 1879 H.M.S. *Orontes* experienced a southerly current of nearly 5 miles an hour, when steaming between Little Basses and Batticaloa.

currents are nearly equally divided ; about twice a month in the south-west monsoon the current will suddenly change from N.N.E. to S.S.W.

During the south-west monsoon, in the event of a sailing vessel making Dondra head, when bound to Galle, which is not uncommon, the master should never attempt to beat to Galle, but recross the equator.

DIRECTIONS.—From the westward.—In the south-west monsoon with the current running to the eastward a ship passing Dondra head will probably be sooner abreast of Great Basses rocks than expected, although the easterly current is not constant, and occasionally during the south-west monsoon sets to the southward and almost always so during the north-east monsoon. Pass Dondra head at a distance of about 9 miles, steering E. by N. or E. by N. $\frac{1}{2}$ N. according to the distance from the land, taking care to sound in time if it be night. Having run in the night about 25 miles to the eastward of Dondra head, a ship should not come into less than 36 fathoms. To the westward of Dondra head, 25 fathoms will carry clear of all dangers by day, and 20 fathoms to the eastward of Dondra head ; but to pass outside the Basses rocks at night, a sailing ship should haul out when approaching them into 40 fathoms. The passage inside the Basses must be considered hazardous with our present knowledge of this coast.

From the northward, and bound west round the Basses in a sailing vessel with the wind fair, keep on the edge of the bank of soundings when approaching the Little Basses, and at night do not come into less than 70 fathoms of water which will keep a vessel from 2 to 4 miles outside the Little Basses and 7 miles outside the Great Basses, the light in both cases being clearly distinguishable, that on the Little Basses white and flashing, that on the Great Basses red and revolving. The uncertainty of the currents must also be considered, particularly near both the Great and Little Basses, where they sometimes set towards the shore (*see* page 65).

THE SOUTH-EAST COAST of Ceylon trends N.E. by E. from Potana point for about 13 miles to Julius Nave point, which latter being low and sandy, is not easily distinguished from seaward. From Julius Nave point the coast continues N.N.E. $\frac{1}{2}$ E. for 16 miles to another projection known as Magami or Panoá point, which is a white sand-heap, the north side of which forms a bluff immediately southward of the entrance to the Navelur river, said to have shoal water extending three-quarters of a mile from it. Aporetotti point just north of the Navelur river projects considerably. Rugged ridge northward of Magami point, is a succession of rugged hills similar in appearance. This part of the coast is low and of sand ; at a distance of 4 miles north of Julius Nave point is a slight projection known as Kirijalle point. The soundings on

the bank bordering this part of the coast, are generally regular, from 3 to 7 miles off are depths of between 17 and 26 fathoms, and between 40 and 50 fathoms will be found near the edge of the bank, from 12 to 15 miles off shore.*

Aganis is the general name of a space of hillock land between lat. $6^{\circ} 50'$ and 7° N., forming the easternmost part of the island of Ceylon. Between the hills north-westward of the Basses, and the hilly land of Aganis, the land is low, except a solitary mountain with double summit about 820 feet high, named Saddle peak, resembling a saddle when seen from the southward. Parakalopo is the most prominent of the Aganis hillocks, it is flat-topped, lies east and west, and its seaward point, named Sankiman Kandi, is the easternmost point of Ceylon.†

In lat. $7^{\circ} 1'$ N., at one mile south of Sankiman-kandi, the *Cyclops* sounded on the south end of a bank, found to extend 4 miles in a N.N.E. direction, with appearances of a deep channel inshore. Four fathoms was the least water obtained, but the bottom was seen from the ship whilst skirting its outer edge in 8 and 10 fathoms, and it is probable that less water exists. An offing of 4 miles is, therefore, recommended to strangers between the parallels of 7° and $7^{\circ} 5'$ N.

About 22 miles inland or westward of the Aganis coast is the table mountain, Westminster Abbey, with a square knob or turret on its north end, 1,258 feet high. Aganis peak is $9\frac{1}{2}$ miles nearer the coast and bears from Westminster Abbey W. $\frac{1}{4}$ S., Lion peak also prominent, bears about S.S.E., distant 7 miles from Westminster Abbey. Pagoda peak in lat. $6^{\circ} 38'$ N. is conspicuous in clear weather.

THE EAST COAST of Ceylon between lat. $6^{\circ} 40'$ and lat. 7° N., presents a rounded appearance towards the sea and is without conspicuous headlands. The Navelur river discharges into the sea in lat. $6^{\circ} 46'$ N., and about $3\frac{1}{2}$ miles to the northward of the entrance is Abrukgam bay, having a rocky headland or knob on its southern side, and a river mouth about 4 miles further to the northward. Tirkoil or Tiri-Kovil, having a pagoda among a grove of cocoa-nut trees, is situated a short distance inland from the coast in lat. $7^{\circ} 5'$ N., and Komari in 7° N.

Northward of the Aganis coast as far as Batticaloa river entrance, the shore continues low, with plantations of cocoa-nut trees, and a few houses or small villages. From some of the points foul ground is said to extend for $1\frac{1}{2}$ miles, rendering it prudent not to come into less than 22 fathoms,

* Horsburgh's Directory, eighth edition, vol. 1, page 563.

† A rock having over it 6 feet of water, amongst soundings of 10 and 12 fathoms, is reported as lying nearly 2 miles E.S.E. from Sankiman Kandi point; from this rock, Aganis peak bears W. by N. (Commander A. D. Taylor, late I.N., 1885.)

especially at night. In about lat. $7^{\circ} 16''$ N. is the entrance of the Singaratopu river, which flows from some distance inland.

Graville rock on which the steam vessel *Graville*, drawing 22 feet, is reported to have struck, August 1885, stated to be composed of coral and of small extent, is situated about $2\frac{3}{4}$ miles from the shore, with Komari point bearing N. by W. $\frac{3}{4}$ W., distant 6 miles.

Reported rock.—The S.S. *Macgregor* in 1881, struck on some rocks bearing approximately S. by E. $\frac{1}{2}$ E., distant $3\frac{1}{2}$ miles from Sankiman Kandi point; she was afterwards beached and became a total wreck.

LAND MARKS.*—The coast near Batticaloa is low, but several mountains are conspicuous in passing this part of the island. Friar's Hood or Wallingbehella (1,563 feet) in about lat. $7^{\circ} 26'$ N., 19 miles from the coast resembles a friar's hood, when seen from the northward, but appears pyramid-shaped from the south. False Hood to the southward is not so high as Friar's Hood. Kettle Bottom, a conical hill in lat. $7^{\circ} 32'$ N., visible in clear weather from the offing, is about 30 miles W.S.W. of the entrance of Batticaloa river. Sugar Loaf or Kottimalli, bearing W. by N. $\frac{1}{4}$ N. distant about 20 miles from the entrance of the Batticaloa river, or in lat. $7^{\circ} 49' 30''$ N., is a sharp isolated cone, about 532 feet high.†

Caution.—The positions of these peaks are but approximately known.

BATTICALOA RIVER,† the coast near which is low, is not discernible except from the northward, the mouth opening in that direction; but its approximate whereabouts may be recognised by a watch house and flagstaff on the western side of the entrance, from which colours are generally shown to passing ships. A difficult bar, on which is usually a depth at low water of 6 feet, but which changes its formation every north-east monsoon, extends across the narrow entrance to the Batticaloa river, which at this time is almost inaccessible. Roads connect Batticaloa with the interior. In the lagoons are immense crocodiles. Exports consist of coffee and timber.

Anchorage during the south-west monsoon may be found in Batticaloa roads about three quarters of a mile from the entrance to the river, in about 6 fathoms sand and coral, with the flagstaff at the river entrance bearing South, and the obelisk S.W. $\frac{1}{2}$ W., but in the north-east monsoon this anchorage is unsafe, a gale from that quarter being liable to happen from September to February.

* See Admiralty chart No. 2,031 of East Coast of Ceylon.

† The heights of Westminster Abbey, Friar's Hood, and other mountains on the Ceylon chart appeared incorrect.—(Remark Book of Staff Commander S. C. Tracey, H.M.S. *Iron Duke*, 1875.)

‡ See plan of Batticaloa road on Admiralty chart No. 2031; scale $m = 3$ inches.

Directions.*—Approaching from the northward, steer for the gap, open bearing S. by E. $\frac{1}{2}$ E., until the flagstaff bears south. Then steer for the flagstaff and anchor as above. Approaching from the southward, stand in with Sugar loaf hill, just clear to the southward of Gunner's Quoin, bearing W. $\frac{1}{2}$ N. till the gap is open, when proceed as before.

There is a master attendant here, and special regulations as to boat traffic. The B. I. S. N. Co.'s steamers call occasionally, and the Ceylon Government coasting steamer twice a month.

Buoys.—A buoy painted red is moored 25 fathoms N.E. by N., and to mark the position, of Surveyor rock, over which is $3\frac{1}{4}$ fathoms of water, with the flagstaff at the entrance to Batticaloa river bearing S. by E. distant $9\frac{1}{4}$ cables. From this position of the buoy, Surveyor and Khandalla rocks are in line with a white obelisk on shore.

A buoy coloured black is placed close to the northward of, and to mark the position of Beacon rock, over which is 2 fathoms of water, with the flagstaff at the entrance of Batticaloa river bearing S.W. $\frac{3}{4}$ W., distant $1\frac{1}{2}$ miles.

These buoys are placed in position only from 15th March to 31st October.

Brennus rock.—North-east of the entrance to Batticaloa river and between Surveyor and Beacon rocks is much foul ground, having depths of $2\frac{1}{2}$ to 3 fathoms. In 1881, the steam vessel *Brennus* struck on a rock, from which Batticaloa flagstaff bears S. 7° W. distant 7 cables. This shoal, which has a least depth of 15 feet, lies $3\frac{1}{4}$ cables N.W. of the 7 feet shoal known as Tower rock, 6 cables W. $\frac{1}{4}$ S. of Beacon rock, and $8\frac{1}{4}$ cables E. by S. of Surveyor rock.

LIGHT.—From the flagstaff at the watch-house on the mainland, near the river bar of Batticaloa, is exhibited a *fixed white* light, at an elevation of 50 feet above the sea, visible in clear weather at a distance of 8 miles.

Tides.—It is high water at full and change in Batticaloa roads at about 5h; ordinary springs rise 2 to 3 feet.

Supplies.—Wood may be procured on the island at the entrance of Batticaloa river, and fresh water can be procured in casks from a well at the fort, $2\frac{1}{4}$ miles up the river.

The COAST from the entrance to Batticaloa river trends N.N.W. $\frac{1}{2}$ W. to Vendelús point, which has detached rocks off it, and shoal water extending $1\frac{1}{4}$ miles, is low and woody, and should not be approached nearer than $2\frac{1}{2}$ miles, when a vessel will be in 20 fathoms of water. Puna Kuda point, situated about midway between the entrance to Batticaloa river and Vendelús point, has rocks extending from it for about three-quarters of a mile. Northward of Puna Kuda point, the receding coast forms a bight known as Puna Kuda bay, northward of which again is Kalkuda bay.

* Remarks by Master Attendant, Colombo, August 1886.

Alphée rock, reported in about lat. $7^{\circ} 24' N.$, long $81^{\circ} 50' 30'' E.$, with a depth over it of 3 fathoms, was searched for in vain by H.M.S. *Vigilant* in December 1864, and probably exists nearer the shore than 2 miles, which the above position would assign to it.

VENDELÚS OR VENLÚS BAY* (the name of Dutch origin) remarkable for its supplies of shells, is little frequented, and has a rocky entrance and shore line fringed with reef. The Valaichchenai or Paskoddi river with a narrow rocky entrance, having over the bar 8 to 9 feet at low water, empties itself into the southern part of the bay. Measured from Vendelús point to the point off which is Elephant or Providien rock, Vendelús bay is about $5\frac{1}{4}$ miles in extent, and about $1\frac{1}{2}$ miles deep.

A 4-fathom bank of circular shape about 2 cables across, is situated in Vendelús bay about 2 miles from the shore, and $2\frac{1}{4}$ miles distant from Vendelús point, from which it bears N. by W.†

Anchorage may be obtained in Vendelús bay in 12 fathoms about 2 miles from the shore, but it is a dangerous locality and should be avoided during the season of easterly winds. In May, 1873, H.M.S. *Nimble* anchored here in $7\frac{1}{4}$ fathoms, sand and coral, with Vendelús point bearing S. $39^{\circ} W.$, and the north extreme of land N. $38^{\circ} W.$

THE COAST from Elephant or Providien rock point of Vendelús bay trends N.N.W. $\frac{1}{2} W.$ for about 36 miles to Foul point, the south-eastern extremity of Trincomalí bay, and is generally low and woody, with steep rocks fronting the sea; but in many places there is a white sand beach. Between distances of 7 and 21 miles southward of Foul point, scattered groups of low rocks line the shore, at distances therefrom of from one to 2 miles, on which the sea breaks high in bad weather; for the position of these the navigator is referred to the chart. The farthest out, termed Alligator rock, 3 feet high, is situated in lat. $8^{\circ} 20' 30'' N.$ at about $1\frac{3}{4}$ miles off-shore.

Virgel river, which enters the sea by two mouths in about lat. $8^{\circ} 16' N.$, is the southern branch of the Mahavilla Ganga (the largest river in Ceylon), the northern branch, the Kurugal Ganga, falling into the southern part of Trincomalí bay. This river rises in the mountainous interior of the island, and after encircling the city of Kandi, flows eastward for about 25 miles, and then northward to the sea; it is said to be a sluggish stream, with banks of swampy ground covered with rank vegetation.

SOUNDINGS.—Between Vendelús bay and Trincomalí the bottom is rocky and uneven. In daylight, with favourable weather, the shore may be

* The SS. *Leith* was wrecked on a 9 foot patch situated about 12 cables, north-east of Vendelús point, in 1873.

† See Plan of Vendelús and Kalkuda bays, scale, $m = 1.7$ inches on Admiralty chart No. 2031.

approached as near as from between 3 and 4 miles, where depths of 15 or 16 fathoms will be met with; but at night, soundings of from 20 to 23 fathoms should be maintained, or a distance of about 6 miles from the coast.

TRINCOMALÍ BAY,* about 3 miles across at its entrance, and affording capacious and safe anchorage to all sizes of ships at all seasons, is divided into two parts,—Great bay, the shores of which are low, and which runs in about 6 miles to the south-west, and Trincomalí harbour about 3 miles in depth, which, with its many armlets forms an irregular prolongation of Great bay to the north-west. The first Europeans who possessed this place were the Portuguese, who lost it to the Dutch, with whom it remained until 1782, when the British captured it, but in turn lost it to the French, who restored it to the Dutch. In 1795, it was again taken by the British after a three weeks' siege, and has since remained in their possession.

Foul point, low and covered with cocoanut trees, on the south side of the entrance to Trincomalí bay, bears S.E. $\frac{1}{2}$ E., distant $5\frac{1}{2}$ miles from Flagstaff point on the north side of the entrance, and has a reef projecting from it to the northward for nearly a mile, with a depth of 9 feet of water over it.

LIGHT.—On Foul point, stands a circular grey tower, 120 feet in height, from which is exhibited, at an elevation of 104 feet above the sea, a *white* light, showing a *flash* every *half minute*, dioptric and of the second order, which should be visible in clear weather at a distance of 17 miles. The tower stands in about lat. $8^{\circ} 32' 10''$ N., long. $81^{\circ} 18' 50''$ E.

Norway point is the next west to Foul point, on the south side of Great bay, from which it bears W.S.W., distant $2\frac{3}{4}$ miles, the coast between being low and forming a shallow bight. About half way between these points, and a mile off shore, is Northesk rock, having 9 feet on it.

GREAT BAY, probably more than 100 fathoms deep in its centre, sweeps round from Norway point in a semicircle to Marble point, which is hilly, and bears from Norway point about west, distant $3\frac{3}{4}$ miles. The shores of the bay out of which the Samboré, the Kottíá, the Mahavilla Ganga, and the Upá or Stately river, discharge themselves, are low. The Kottíá sand, having a depth of 3 to 4 fathoms on its outer edge, stretches off the mouth of the Kottíá river to the northward for a distance of 6 cables. Nearly half a mile N.W. by W. of the entrance to the Samboré river is the Samboré shoal, having over it $2\frac{3}{4}$ fathoms, rock. Tamblegam shoal of

* See Admiralty plan of Trincomalí harbour and bays, No. 815, scale, $m = 1.7$ inches; also No. 816 of Trincomalí harbour, scale, $m = 6$ inches; and plan of Trincomalí harbour, scale $m = 1.3$ inches, on Admiralty chart, No. 2,031.

9 feet is distant $5\frac{1}{2}$ cables from the shore in the western part of the bay and bears S.S.W., distant $1\frac{4}{10}$ miles from Marble point.

Pigeon or Elizabeth island, lies S.E. distant one mile from Marble point, and the entrance to the extensive lake Tanglegam, well marked by the islet of Noddi Tevú, finds its way into Great bay about a mile westward of Marble point.

Marble point, the western extremity of Great bay, terminates a spur from the elevated land known as Diamond hill, and has off it depths of less than 3 fathoms, extending about 4 cables to the south-east.

Niger rock on which Her Majesty's ship of that name struck in 1864, having over it 5 feet of water, bears S.E. by E. $\frac{1}{4}$ E., distant $4\frac{1}{2}$ cables from Marble point.

Round island, about a cable in extent north-east and south-west, and 50 feet in height, bears E. by N. $\frac{3}{4}$ N., distant 8 cables from Marble point, and has shoal water extending for about $1\frac{1}{2}$ cables from its south-west point.

LIGHT.-- On the summit and near the centre of Round island, is a circular grey lighthouse, 69 feet in height, from which is exhibited at an elevation of 103 feet above the sea, a *fixed white* light, dioptric and of the fourth order, which should be visible in clear weather at a distance of 10 miles.*

FLAGSTAFF POINT, on the north side of entrance to Trincomali bay is high, steep to seaward, covered with trees, and forms a tongue, jutting to the northward from the crooked peninsula that bounds the east side of Trincomali harbour. On the southern part of this tongue, is fort Frederick, with a flagstaff standing in a prominent position, near its northern part, which is 170 feet in height.

Chapel point, the hill over which is 420 feet high, is the south-east extremity of the peninsula of which Flagstaff point is the northern limit, from which it is distant $2\frac{1}{2}$ miles to the southward; between, jut out Dutch and Rocky points, at distances of $1\frac{1}{10}$ and $1\frac{3}{10}$ miles respectively from Flagstaff point, on about a South bearing.

Chapel island, distant $1\frac{1}{4}$ cables to the south-east of Chapel point, has shoal water between it and the point, and dry rocks extending from it $1\frac{1}{2}$ cables to the south-west.

Chapel rock, above water, bears N.E. $\frac{3}{4}$ E. distant $4\frac{1}{2}$ cables from Chapel island, and to the north-east of it, at distances of one and 2 cables are depths of 2 and $2\frac{1}{2}$ fathoms.

* Reported by Nav.-Lieut. T. Robertson, H.M.S. *Undaunted*, to have been seen 16 miles, 1878.

Elephant point is the south-west termination of the high promontory forming the eastern side of Trincomali harbour, and bears about S.W. by W. from Chapel point, distant nearly $1\frac{1}{4}$ miles.

Elephant island, 4 cables south-east of Elephant point, is about 3 cables in extent north-east and south-west, and 30 feet high; foul ground exists between Elephant island and point, and also extends $1\frac{1}{4}$ cables westward of the west point of Elephant island, where a white buoy marks Elephant rock, its outside or western limit, over which is a depth of 4 feet.

Clappenberg point, the eastern extreme of Clappenberg island, bears W. by S. $\frac{1}{2}$ S., distant 8 cables from Elephant point. A shoal having on it a depth of 4 fathoms, lies one and a half cables N.E. from Clappenberg point.

TRINCOMALÍ HARBOUR.—**Ostenberg point*** bears N.W. $\frac{1}{2}$ N. distant $5\frac{1}{2}$ cables from Elephant point, the hill over it being precipitous and fortified. Nicholson cove runs in for 6 cables in a north-east direction, between Ostenberg and Elephant points, and has depths of from 8 to 15 fathoms. On the north side of Ostenberg point is the Naval Yard, about $3\frac{1}{2}$ cables northward of which, is the usual man-of-war anchorage.

BUOYS.—In Trincomali harbour besides the white buoy marking Elephant rock (already described) are the following :—

Two white buoys at distances of three-quarters of a cable, and $1\frac{1}{4}$ cables on a N.W. by W. $\frac{1}{2}$ W. bearing from the flagstaff at the Naval Yard, mark the western and eastern limits of a detached shoal, on which is a depth of as little as 3 feet. A channel about half a cable in width, and carrying a depth of $4\frac{1}{2}$ fathoms, lies between the foreshore of the Naval Yard and the eastern white buoy.

A chequered black and white buoy, marks the western extremity of York shoal, on the north side of the man-of-war anchorage. The buoy lies in 23 feet of water, with Round island lighthouse just open of Ostenberg point, bearing S. by E., and Admiral's flagstaff N.E. by E. $\frac{1}{4}$ E. Vessels must not attempt to pass between this buoy and York island, situated about 4 cables to the eastward of it.

A conical white buoy is moored in $3\frac{1}{2}$ fathoms on the west side of Kerbela rock, over which, in July 1883, a depth of 15 feet was found, in the approach to the merchant vessels anchorage. This buoy bears N. by E. $\frac{3}{4}$ E. from the chequered black and white buoy marking the

* Vessels are cautioned that until the 28th February 1887, a red buoy with red flag and the words "Torpedo buoy" on it, is placed between Ostenberg point and Small Sober island, 250 yards from the latter, to mark the eastern limit of the Submarine mining field which extends over the triangle formed by the buoy, the north-east point of Great Sober island and Clappenberg point.

western extreme of York shoal, distant $1\frac{1}{10}$ cables. From it, the south end of York island bears N. 88° E., and the flagstaff at the Naval Yard S. 18° E.

A white buoy marks the Minden rock, over which is 11 feet, on the west side of the approach to Trincomalí harbour; from it, Clappenberg point bears N.W. $\frac{1}{2}$ N., distant nearly 3 cables. The channel into the harbour, $7\frac{1}{2}$ cables wide, lies between the white buoy marking Minden rock on the west, and that marking Elephant rock on the east. The north and western parts of Trincomalí harbour are much indented by numerous small bays or coves, the whole tending to form a considerable sheet of water, having anchoring ground all over it in depths varying from 7 to 15 fathoms, for the position and details of which, the chart is the best guide.

GREAT SOBER ISLAND, 6 cables long, north and south, by 4 cables in width, the summit of which, termed Gravel hill, is 240 feet in height, lies half a mile westward of Ostenberg point, and is separated from the western shores of Trincomalí bay by French pass, 2 cables in width, and having 16 feet in the shoalest part of the channel, which is seldom used.

Small Sober island, about half a cable distant from Great Sober island, is about $1\frac{1}{2}$ cables in extent, north and south, by $1\frac{3}{4}$ cables east and west, and 116 feet high. Shoal ground connects it with the south-east point of Great Sober island, and also extends about a third of a cable from its eastern shore, between which and Ostenberg point, is the channel into Trincomalí harbour, about $2\frac{1}{4}$ cables in width.

From the Sober islands southward to Marble point, a distance of $1\frac{3}{4}$ miles, the western shore of Trincomalí bay maintains its hilly nature, and is deeply indented with picturesque coves, or small bays, for which the chart is the best reference. Grommet rock, detached, and 3 feet above water, lies $2\frac{1}{2}$ cables S.S.W. $\frac{1}{2}$ W. from Minden rock in the south-west part of the approach to the harbour, otherwise, there are no obstructions to navigation not already mentioned.

DIRECTIONS from the southward, in approaching Trincomalí bring Foul point light to bear West, distant 2 miles, and then steer N.W. until Round island light bears W.S.W., on which course it should be steered for, until Chapel hill (the high bluff eastern extreme of land on the north side of entrance) bears North, distant about $1\frac{1}{2}$ miles, then alter course to W. by N. until Round island light bears S. by E. $\frac{1}{2}$ E., then steer N. by W. $\frac{1}{2}$ W. passing midway between the east point of Small Sober island and Ostenberg point, and anchor with Round island light bearing S. by E. $\frac{1}{2}$ E. in 12 fathoms. After passing Ostenberg point the water shoals gradually from 25 to 12 fathoms.

From the northward when Foul point light is seen, bring it to bear S. by E. $\frac{1}{2}$ E., and steer for it until Round island light bears S.W. $\frac{1}{2}$ W.,

then steer for Round island light until Chapel hill bears N. by E. $\frac{1}{2}$ E., then proceed as before.

TIDES.—It is high water, full and change, at Trincomalí at about 8h. 18m.; springs rise 2 and neaps $1\frac{1}{2}$ feet. There is sometimes a tidal stream of from 1 to $1\frac{1}{2}$ knots in or out of the harbour, and the under current differs occasionally from that of the surface.*

CURRENT.—The set of the current for some distance outside of Trincomalí appears irregular,† except perhaps in the months of November and December, when a southerly set of from 2 to $3\frac{1}{2}$ knots may be expected. During the south-west monsoon the current is fluctuating and weak. Captain Horsburgh and Lieutenant Heathcote, I.N., the two best known authorities, held opinions at variance on this subject.‡

During the north-east monsoon, between the point of Tirkoil (lat. 7° N. and Batticaloa, whilst in the offing, the current has been found running strong to the south, close in shore, at the same time an eddy has been met, setting 2 knots to the north.§ In August, between Batticaloa and Trincomalí, within 5 miles of the land, a northerly set of 1·5 to 3 knots has been met with, while outside this distance, a southerly set of one knot has been experienced.||

In the absence of continuous systematic observations, no fixed rules can be established. It would appear that the direction and force of the currents differ at various distances from the coast, and are affected also by the prevailing winds, and possibly other disturbing influences. The following table has been compiled from the Remark Books of H.M. ships in the East Indies :—

CURRENTS EXPERIENCED IN APPROACHING TRINCOMALÍ.

Date.	Ship.	Direction.	Force.	REMARKS.
Jan. 21st, 1877 -	H.M.S. <i>Himalaya</i> -	Northerly	1 knot -	—
Jan. 28th, 1871 -	H.M.S. <i>Cossack</i> -	Westerly	1 knot -	Approaching Trincomali from eastward.
Feb. 15th, 1875 -	H.M.S. <i>Iron Duke</i> -	Northerly	21' in 24 hrs.	By directions led to expect a current in the contrary direction.
Feb. 28th, 1871 -	H.M.S. <i>Cossack</i> -	Nil -	Nil -	—
March 9th, 1877 -	H.M.S. <i>Arab</i> -	W.N.W. -	15' in 18 hrs.	Land made to northward of Trincomali, a southerly set allowed for in shaping course.

* Commander C. Johnstone, H.M.S. *Dryad*, remarked a tidal stream from the 3rd gradually increasing until the 20th December 1883.

† Information gathered by H.M.S. *Glasgow*, flag ship in the East Indies for four years.

‡ Journal of Royal Geographical Society for 1862, p. 234, Lieutenant Heathcote, I.N., "On the currents of the bay of Bengal during the south-west monsoon."

§ Remarks by Commander C. Murray Aynsley, H.M.S. *Assurance*, 1861.

|| Navigating Lieutenant J. Henderson's Remark Book, H.M.S. *Ruby*, 1878.

Date.	Ship.	Direction.	Force.	REMARKS.
March 31st, 1851	H.M.S. <i>Salamander</i>	Nil - -	Nil	No current. Anticipated 2 knot set to northward, shaped course accordingly, but found no set.
April 5th, 1878	H.M.S. <i>Rifleman</i>	N.W. - -	- - -	—
May 7th, 1867	H.M.S. <i>Wasp</i>	Southerly	Slight	Between Little Basses and Trincomali current setting to southward.
May 26th, 1881	H.M.S. <i>Ready</i>	S.W. by S.	1 knot	—
June 9th, 1871	H.M.S. <i>Cossack</i>	Nil - -	Nil - -	S.W. monsoon blowing.
July 7th, 1867	H.M.S. <i>Cossack</i>	S.E. by E.	1·5 knots	—
July 11th, 1877	H.M.S. <i>Undaunted</i>	N.E. - -	1 knot	—
July 29th, 1867	H.M.S. <i>Undaunted</i>	S.E. - -	0·5 knots	—
August 24th, 1863	H.M.S. <i>Hornet</i>	Southerly	Not strong	Between Trincomali and Basses rocks.
August 28th, 1878	H.M.S. <i>Ruby</i>	Variable	- - -	Bound to Trincomali, after passing Batticaloa hauled within 5 miles of the land, when current which had been setting one knot to southward, set to northward from 1·5 to 3 knots.
Sept. 3rd, 1880	H.M.S. <i>Euryalus</i>	Southerly	1·5 knots	Currents round Ceylon hardly perceptible, except between Batticaloa and Trincomali where it set to southward.
Oct. 27th, 1877	H.M.S. <i>Rifleman</i>	N.N.W. -	2 knots (nearly)	Under steam, bound to port Blair.
Nov. 3rd and 4th, 1874.	H.M.S. <i>Glasgow</i>	Nil - -	Nil - -	Current 2 to 3 knots to southward, between Navelur river and Vendelús bay; current suddenly ceased (lat. 8° 8' N., long. 81° 40' E.)
Nov. 20th, 1872	H.M.S. <i>Glasgow</i>	S. by E. -	3 knots	Trincomali to Batticaloa, S. by E. 3 knots; Batticaloa to Little Basses, parallel with coast 2½ knots; thence to Galle, to westward 1½ knots.
Nov. 20th, 1880	H.M.S. <i>Euryalus</i>	Southerly	3·7 knots	Between Trincomali and Batticaloa, and Batticaloa and Dondra, current, setting to southward 3·7 knots.
Dec. 10th, 1847	H.M.S. <i>For</i>	S. 30° E.	3·6 knots	—
Dec. 24th, 1879	H.M.S. <i>Glasgow</i>	S.S.E. -	2 knots (nearly)	Destination, Calcutta, steam and sail, stretched to seaward out of the strong current.

From the foregoing data the following deductions appear justifiable when approaching Trincomali—

From end of October to end of December expect a strong southerly set of 2 to 3·5 knots an hour. From December to March, a weak northerly set not exceeding 1 knot an hour. From March to September, a variable current, not strong. In September and October, an irregular current, sometimes strong to the north, at others to the south.

Anchorage in Trincomali harbour. That for vessels of war, is in the bight between Ostenberg point and York island and shoal, in about 10 fathoms, mud. The mercantile anchorage is nearer the town, to the north

ward of York island, in from 6 to 8 fathoms, with the landing wharf bearing N.E. $\frac{3}{4}$ E., and York island South.

Harbour Lights.—During the presence of a ship of war, a red light is shown from the Naval Yard on the north side of Ostenberg point, and when the colonial steam vessel is expected, a similar light is exhibited from the end of the pier, north-eastward of the merchant vessels anchorage.

TRINCOMALÍ, which, with exception of the official buildings, is poorly constructed, is built on the neck of the peninsula on the north-east side of the bay, which peninsula rising at its southern end, forms the high land on the north side of entrance to the harbour, in steep hills covered with forest. Few merchant vessels call here, and the export trade consists only of a small quantity of cocca-nut oil and tobacco.*

Trincomalí is the head-quarters of the Royal Navy in the East Indies, but apart from its excellent harbour the advantages are few. The Admiral's house and grounds are situated on rising ground nearly a mile north-east of the anchorage; near at hand is a rest house for the use of the sailors of the fleet. On Sober island, are three bungalows used by the officers of H.M. ships visiting the harbour. The bay is surrounded by country very little inhabited, and provisions are brought in by water carriage.

Supplies of wood and coal, fresh water, beef, and vegetables may be procured.

Climate of Trincomalí differs from that of the south or west coast of Ceylon, bearing a greater resemblance to that of Hindustán southward of Madras. The south-west monsoon, which at Colombo is characterised by extreme moisture, is here experienced as a hot dry land wind, during the continuance of which, from April to September, there are only a few slight showers, and the thermometer in the shade stands sometimes at 95°; while the north-east monsoon, prevailing from October to March, is accompanied by heavy rains, or occasional showers, and a temperature varying from 76° to 84°. The heat thus follows the course of the sun, but is modified in effect by land and sea breezes. (See also page .)

Working in to Trincomali bay against a westerly wind will be found difficult, as there is then, at times, a strong outset from the southern part of the bay. Ships in the south-west monsoon generally fall in with the land to the southward of the bay. To avoid the out-set, work up abreast, or in the same latitude with Back bay and Flagstaff point, until close in with this part of the land, then stand to the south past Chapel reef (of which be careful) until Round island just touches Marble point, which is a good tacking mark, until a ship is well to the westward of Norway island. In approaching the bottom of the bay, the lead must be kept going, and it is imprudent to shoal into less than 12 or 14 fathoms. In standing to the

* In 1885, it was contemplated to excavate a dry dock, capable of accommodating the largest sized ships.

northward for the entrance of the harbour a sailing vessel may pass close to Round island; from thence she will probably reach the harbour's mouth without tacking. Then anchor as convenient, to the north-east of Great Sober island.

BACK BAY, on the north side of the peninsula forming Trincomali harbour, is about 3 miles wide and a mile deep, and may be resorted to during westerly winds; the anchorage in 7 to 10 fathoms, sand, being situated with Flagstaff point bearing from S. by E. to S.E. by S. distant about a mile. During the north-east monsoon, or from the middle of October to the middle of March, Back bay is an unsafe anchorage.

The coast.—Elizabeth point, the north extreme of Back bay, has foul ground extending eastward from it for half a mile. Heroine rock is small and under water, and bears from Elizabeth point S.S. E. $\frac{1}{4}$ E., distant three-quarters of a mile.

The Lively rock appears small and sunken, and bears from Elizabeth point E. $\frac{1}{2}$ N., distant nearly half a mile. It is near the eastern edge of the shallow water extending eastward of Elizabeth point.

Clearing mark.—Vessels should not close the coast northward of Flagstaff point, with that point bearing anything to the eastward of S. $\frac{1}{2}$ E.

The Pullakulla or Salt lake, connects with the sea at about half a mile south of Elizabeth point; on the south side of the narrow channel leading into the lake, is a hill, 100 feet high, overlooking the sea, having a bungalow on its summit.

THE COAST northward of Elizabeth point should not be approached nearer than 2 miles or a depth of 20 fathoms, foul ground extending seaward from it for about $1\frac{1}{2}$ miles. Nilavelli village, about 8 miles north-west of Trincomali, and near the sea coast, produces much salt.

Fairlie rock, on which a ship of that name struck, and the Diomedé rock, on which H.M. ship of that name grounded, are situated, the first S. 41° E. distant nearly 2 miles, and the latter S. 27° E. distant $3\frac{1}{2}$ miles, from Pigeon island, and about $1\frac{1}{2}$ miles from the shore near Elizabeth point.*

Pigeon island, 99 feet high, bearing from Flagstaff point of Trincomali N. by W. $\frac{3}{4}$ W., distant 8 miles, is rocky, with a few shrubs on it, and on account of the foul ground surrounding it should not be approached nearer than 2 miles.

Mount Erasmus, 310 feet high, stands westward of Pigeon island; Pinnacle hill (about 150 feet) having a sharp finger-like peak, stands northward of mount Erasmus.

* It is possible that the two shoals are identical.

The bank of soundings between Pigeon island and Trincomali seldom exceeds 3 or 4 miles distance from the shore, and from depths of 40 fathoms drops suddenly to no bottom at 80 fathoms.

The coast.—Boulder point, which protrudes slightly, is about 10 miles northwest of Pigeon island. Red Cross river mouth is a little north of Boulder point, and at 8 miles further to the north-west, is the entrance of lake Kokelé; about the same distance further north are some conspicuous red cliffs; but between Boulder point and Muletivu, the coast has few distinguishing features, showing a fringe of trees of uniform height, without hills.

MULETIVU SHOALS or Moeletivoe extending about $5\frac{1}{2}$ miles from the coast, in lat. $9^{\circ} 16' N.$, are of sand, and have depths of from 6 to 12 feet over them; their northern side being composed of detached knolls, on which the sea breaks heavily in the north-east monsoon. A Custom house stands on the sea coast abreast them, about $1\frac{1}{2}$ miles south of Sandy point where the Watoe Wakal river in a series of lagoons, running parallel to and inside the coast, leads into the sea.* North of Sandy point the coast trends more to the westward, the shore in this neighbourhood being low, and so continuing to point Pedro the north-east extremity of Ceylon.

Caution.—As the Muletivu shoals are reported to be extending seaward, vessels in passing should not approach this part of the coast in a less depth than 20 fathoms.

POINT PEDRO SHOAL, having over it from $2\frac{1}{4}$ to 4 fathoms, encompasses the north-east part of the island, and stretches parallel to the coast for about 24 miles to the south-east.

An obelisk 50 feet high, painted white, is situated on the north-east coast of Ceylon in about lat. $9^{\circ} 33' 35'' N.$, long. $80^{\circ} 28' 30'' E.$, and when brought to bear W. by S. $\frac{1}{4}$ S., clears the south end of the point Pedro shoal in about 7 fathoms of water.

Ethiopia shoal, on which the vessel of that name touched in 1878, has a depth of 12 feet, and lies at the south-west or inshore elbow of the southern portion of the point Pedro shoal; from it, point Pedro bears N.W., distant $12\frac{1}{4}$ miles, and Kudaripu (on the coast abreast) S. $77^{\circ} W.$ $3\frac{1}{2}$ miles.

Between point Pedro shoal and the north-east coast of Ceylon is a channel from 2 to 3 miles wide, having depths of 6 to 7 fathoms soft mud, by means of which Palk bay and the Pámbam (Paumben) passage may be reached.

* There is a conspicuous bungalow with a red roof in the village of Muletivu, close down to the beach, and a building with a white cross about half a mile to the northward of it. These two buildings are the only conspicuous objects from the offing. Remark book of Lieut. J. F. Stuart, H.M.S. *Ranger*, November 1885.

POINT PEDRO, a well defined tree bluff on the north-east point of Ceylon, is low, as also is the whole of the north-east coast of Ceylon northward of lat. $9^{\circ} 10'$ N. The small town of Purrititori, where there is a Custom house and several bungalows on the beach, lies about a mile westward of the point, and is the chief shipping place of the district. The main staple is tobacco. Three miles west of point Pedro is Palmyra point, the northern point of Ceylon, having upon it some palmyra trees.

A coral reef fringes the coast from point Pedro to the westward, extending about a quarter of a mile from the shore, being farthest from the beach, at the point itself. Abreast of the Custom house at Purrititori, a boat channel has been made through the reef to the beach.

DIRECTIONS.—Sailing vessels from Trincomali proceeding to the north part of Ceylon, inside or south of the Pedro shoal, should keep near the north-east coast of Ceylon steering N. by W. from near Flagstaff point until clear of Pigeon island, taking care not to shoal into less than 20 fathoms by day, or 24 fathoms by night. After passing Muletivu shoal in 20 fathoms, the coast to the northward should not be approached nearer than 9 fathoms, until in lat. $9^{\circ} 34'$ N.* Then proceed as necessary, using the white obelisk as a guide for clearing the south tail of the Pedro shoal, and after entering the channel between that shoal and the land, keep along shore at about a distance of $1\frac{1}{2}$ miles. In case of the wind baffling, or at night, if necessary, good anchorage may be had in any part of the channel between Pedro shoal and Pedro point. Vessels should not borrow on the point Pedro shoals, as there may be less water on them than is shown on the chart.

* In 1881, the *Mars* reported having grounded on a bank with 40 fathoms close-to, in lat. $9^{\circ} 8'$ N., long. $81^{\circ} 4'$ E., or about 9 miles from the north-east coast of Ceylon. The report hardly seemed of a satisfactory nature.

CHAPTER III.

PALK STRAIT AND COROMANDEL COAST, PEDRO POINT AND
PALK BAY WITH PÁMBAM PASS TO COCANADA.

Variation 1° 50' East in 1887.

PALK STRAIT,* so-named after the Dutch Governor who first navigated it, separates Ceylon from the south-east part of the peninsula of Hindustán, and at its entrance, between Palmyra point and Calimere point, is about 33 miles in width. The old Dutch navigators mention three passages through the strait, the southern one of which, between the north coast of Ceylon and the shoals which form a middle ground, is the original Palk strait. To the south-west, Palk strait opens out into a considerable sheet of water, stretching about 60 miles in that direction, and about the same distance further to the south-east, known as Palk bay, having over it depths of from 6 to 7 fathoms, with a muddy bottom. Palk bay washes the north coast of Ceylon on its eastern side, and the coast of Tanjore and Madura on its western. The islands of Rameswaram and Manár, with their shoal connection, known as Adams Bridge, form an above water bar, or breakwater, at the head of Palk bay, dividing its waters from those of the gulf of Manár; the Pambam pass between Rameswaram island and the Hindustán coast, forming a narrow connecting channel.

DIRECTIONS.†—There are two recognised entrances into Palk bay; one between Calimere point and the north end of the Middle banks has from 19 to 24 feet of water; the other (Palk strait proper), between the south end of the Middle banks and the north coast of Ceylon, was formerly said to carry $5\frac{1}{2}$ fathoms, but of recent years it has been found, that not more than 26 feet at low water, can be reckoned upon in crossing the Pedro shoals, in the eastern part of the strait, and near the western limit of the strait, or at about 5 miles northward of Kara Tivo island, the continuation of the Middle Ground presents obstructive depths of from $3\frac{1}{2}$ to 5 fathoms

* See Admiralty chart, No. 828, of cape Comorin to Cocanada, and No. 68a of Palk strait and gulf of Manár, scale, $m = 0\cdot24$ inch.

† From Directions published by Mr. J. J. Franklin, R.N., Superintendent of Marine Madras, 1845.

at low water. It is recommended, however, that vessels drawing more than 12 feet, unless aided by steam, or with a leading wind, should use the southern channel.

POINT PALMYRA, the northernmost point of Ceylon, lies about 3 miles westward of point Pedro. It may be readily recognised from the north-west or south-east by the palmyra trees growing on it. A coral reef fringes point Palmyra in common with the north coast of Ceylon generally, to a distance off-shore, of about a quarter of a mile, extending as far eastward as point Pedro.

Valvetti-torai is a small port on the north coast, about $3\frac{1}{2}$ miles westward of point Palmyra, or $6\frac{1}{2}$ miles westward of point Pedro, and is subject to the same port rules as point Pedro.

Tondi-manár is a village situated about 8 miles westward of point Pedro; the entrance to the back-water here forms a conspicuous gap when seen from the northward. The best passage across the Pedro shoals is off this place. With Tondi-manár gap bearing South a little westerly, depths of $4\frac{1}{4}$ and $4\frac{1}{2}$ fathoms may be carried across the shoals.

Kankasen-torai, situated about $7\frac{1}{4}$ miles westward of Valvetti-torai, contains a larger population than point Pedro, and native vessels of considerable size are built here. It is a smooth anchorage during the south-west monsoon, and that of Jafnapatam being fully exposed, has recently become of importance. The best mark for recognising Kankasen-torai by, is Nira-malai, a grove of crab trees about 40 feet higher than the surrounding trees, and visible at a distance of 13 miles. There is a custom house and master attendant's office here, with special regulations as to boat hire, &c.

NORTH CHANNEL.—After rounding the spit that stretches about a mile eastward of Calimere point, in about $3\frac{1}{2}$ fathoms, at a distance of $3\frac{1}{2}$ miles from the shore, vessels may stand S.W. $\frac{1}{2}$ S., keeping in $3\frac{1}{2}$ to 4 fathoms. This channel is 3 miles wide, having a 2-fathom patch about a mile inside its south boundary, at the distance of 4 miles S.S.E. of Calimere point. The depths on each side vary from 2 to 3 fathoms hard sand; while those mid-channel are from $3\frac{1}{4}$ to 4 fathoms, generally mud.

Middle banks.*—From a position about 4 miles S.S.E. of Calimere point, the Middle banks extend in a southerly direction to within about

* The shoals lying north-westward of Kara-Tivo, now (1884) almost join the Middle banks, thus practically barring the navigation for large vessels between Delft island and point Calimere. During the last half century, the strait between those places has shoaled very much, in patches or lumps, and the navigation become worse. At present no precise instructions can be given for the passage of a large vessel across Kara-Tivo shoals.—*Commander A. D. Taylor (late I.N.).*

8 miles of the north coast of Ceylon, having an average breadth of 3 miles, with uneven soundings of from 2 to $3\frac{1}{2}$ fathoms, and in two places patches of 9 feet. These patches are situated on the bearing of S. 20° E. from Calimere point, distant respectively 6 and $8\frac{1}{2}$ miles, and the bottom is of hard sand. There is generally a swash over the Middle banks, which renders it hazardous to be on them in an open boat during a breeze.

In about lat. $10^{\circ} 6' N.$ there appears to be a break in the Middle banks, about $3\frac{1}{2}$ miles wide, having depths of from $3\frac{1}{4}$ to $4\frac{1}{4}$ fathoms (probably the third passage of the Dutch) for the position of which the chart is the best guide. No explicit directions can be given for its navigation, nor can the Middle banks be said to have been completely surveyed.

In working into Palk bay against the south-west monsoon, a vessel should stand over to the north coast of Ceylon, and work down to Nedoan Tivo or Delft island, whence a stretch may be made across the bay to its western side, where land and sea breezes, with smooth water, will be met with.

In the north-east monsoon, a vessel should also work up on the Ceylon side of Palk strait as far as Elewa Tivo (westward of Kayts), when a board may be made over to the western side of Palk bay, and a vessel may then creep to windward in smooth water.

Current in the middle of Palk bay sets to leeward with either monsoon, and it is therefore necessary to take every advantage of smooth water and weather shores as recommended above.

WIND AND WEATHER.—In Palk bay, as in the gulf of Manár the south-west winds generally commence about the middle of April, with fine clear weather. Early in May, the south-west monsoon blows fresh, and continues until about the middle of August, when it moderates, gradually dying away about the end of September; the sky then becomes overcast, and about the 10th of October the north-east monsoon commences with hard squalls from different quarters, accompanied by heavy rain, thunder, and lightning, which weather continues during the month. The wind then becomes steady from the north east; but during the months of November, December, and January, there are frequent gales and much rain. In the early part of February, the north-east winds take off, and regular sea and land breezes set in, which continue until the middle of March, when calms prevail for several days, and the heat increases until the return of the south-west winds in April.

KAYTS HARBOUR or Orratorai, situated between the island of that name and Kára Tivo, can be entered by vessels of 8 feet draught at high water. The entrance channel lies across the coral flats extending

between Kára Tivo and Elewa Tivo, where there is $7\frac{1}{2}$ feet at low water springs, with a rise of about 15 inches.

DIRECTIONS.—To avoid the foul ground which extends $1\frac{1}{2}$ miles to the westward of the north-west part of Kara Tivo, keep in 5 fathoms, until Elewa Tivo bears S. by W., then steer for Elewa Tivo shoaling to 3 fathoms, until Fort Hammonhiel on the south-west point of Kára Tivo bears S.E. by S., when steer for it, keeping the Custom house point, on which is a large clumpy tree, over the low sandy point of Kara Tivo, till within a quarter of a mile. A vessel will now be in 9 feet, smooth water, and keeping more to the south, may round Hammonhiel fort at a distance of from one to three cables, care being taken, when the fort has been rounded, to keep on the north side of the harbour, until past a bungalow, there situated. The best anchorage is off the custom house in about 2 fathoms, mud.

Outside anchorage in smooth water may be obtained off Kayts harbour, in either monsoon, in about 13 feet, with Hammoniel fort bearing S.E., distant $1\frac{1}{2}$ miles. Large vessels should anchor further out, but a depth of 4 fathoms cannot be relied upon at a less distance than 3 miles, with fort Hammonhiel on a S.E. bearing.

JAFNAPATAM, about 8 miles eastward off Kayts harbour, is situated on the north side of a shallow inlet between Mandi Tivo and the mainland of Ceylon. This is the principal town of the vicinity, and the anchorage near it, is approached from the south-east, between Mandi Tivo and Kalmoene point, but it is only available for vessels of small draught; shoal ground, over which depths of one fathom will be found, lies in the approach, $2\frac{1}{2}$ miles to the southward of the landing place. No trustworthy directions can be given, the chart being the best guide. The inhabitants are principally Tamils. There is a custom house and master attendant. Special regulations are in force as to the hire of boats for landing or shipping cargo.

Anchorage for a large vessel desirous of communicating with Jafnapatam, may be had in $4\frac{1}{2}$ fathoms at the distance of $1\frac{1}{2}$ miles south of the south-east point of Mandi Tivo, but this position is unsafe from the middle of May to the middle of August, when the south-west monsoon, from which there is no shelter on this part of the coast, blows with great violence.

Delft island.—When the north-east monsoon blows fresh into Palk bay, in December and January, small vessels will find good temporary shelter at night on the west side of of Nedoan Tivo or Delft island, in 5 fathoms, mud, with the extremes of the island bearing between N.N.E. and S.S.E., and the south end of some high brab trees, E.N.E.

Pesalai is a small port on the north-east side of Manár island, affording good shelter during the south-west monsoon. The port regulations are similar to those in force at the port of Manár.

THE COAST of the eastern side of Palk bay forms a considerable double bight between Jafnapatam and Manár island, both parts of which are fringed with foul ground and extensive banks of mud and sand, studded with small islands. Immediately south of Jafnapatam, and between the coast at that place and Kalmoene point, is the entrance to a shallow lagoon, about 3 miles wide at its mouth, which extends to the south-east for about 37 miles, finding an exit on the eastern coast of Ceylon, at high water, and effectually insulating the northern part, in about lat. $9^{\circ} 30' N.$, from the main body of the island. There are no ports or anchorage on this part of the coast, for the features of which the chart should be consulted.

MANÁR ISLAND is separated from the mainland of Ceylon by a narrow channel, said to have 10 or 12 feet water in some places. The island is about 15 miles in length S.E. by E. and N.W. by W., and its western point bears S.W. by S., 36 miles from Kalmoene point. The south-west face of the island has low sand-hills for about 5 miles; the western end has abundance of cocoa and other palm trees near the villages. The barren sand-drifts of this island are incapable of producing sufficient grain for its inhabitants. The most singular objects are the monstrous baobab trees; one of the largest, at Manár, has been found to measure 30 feet in circumference, although it was little more in height.

The town of Manár is at the east end of the island, amongst cocoa-nut trees, and presents an aspect of industry and comfort; its fort, which was built by the Portuguese, and strengthened by the Dutch, is in tolerable repair. Manár was anciently the seat of the pearl fishery, but its importance has greatly declined; a considerable portion of the trade between the east and west coasts of India was carried on through the narrow channel which separates the island from Ceylon, and there were establishments at Mantotti on the mainland, as well as on the island, for unloading and reloading such craft as it was necessary to lighten in order to assist them over the shoals.

The bank of soundings extends from 18 to 22 miles to the south-west of Manár island.

Manár port is near the east end of Manár island and is sheltered, but has a south bar and a north bar, at each of which the custom house boats examine small vessels before entering. Special rules apply here for boat hire, according to the season of the year.

ADAM'S BRIDGE.—This barrier is a narrow ridge of sand and rocks, mostly dry, forming the head of the gulf of Manár, and, with the islands of Rameswaram near the Indian side, and Manár on the Ceylon side,

almost connecting the latter with the continent. It extends nearly east and west, 16 or 17 miles, and is for the most part composed of shifting sand-banks with small intricate channels between them, in which the average depth is 4 feet at low water. The edge of the bank of soundings is 12 miles to the south-west of Adam's Bridge.

RAMESWARAM ISLAND, lying between Adam's Bridge and the south-east cape of Hindustán, is low and sandy, and well-planted with cocoa-nut trees towards its west end. In length, nearly E.S.E. and W.N.W., it measures 14 miles; its eastern half is a narrow strip of sand, but the breadth of the island, where the great temple stands, is nearly 5 miles. It is uncultivated, and principally inhabited by Brahmans and their followers, who are supported by the profits derived from the temples. The village of Thani Kodi, at the east extreme of the island, bears W. by N. $\frac{1}{2}$ N., 16 miles from the west end of Manár island.

The great temple, or coil, stands on rising ground, on the north part of the island, in a quadrangular enclosure 650 feet broad by about 1,000 feet long, and is entered by a gateway 100 feet high; it bears north-west 10 miles from Thani Kodi, and E. $\frac{1}{2}$ N. 5 miles from Pámbam lighthouse. Thousands of pilgrims from India resort here. To the south of the great temple is a fresh-water lake, about 3 miles in circumference. The town of Rameswaram stands north-east of the lake, and south-east of the temple, on the eastern sea-face of the island.

Rocks awash lie about $1\frac{1}{2}$ miles eastward of the north-east end of Rameswaram island, where the soundings should not be shoaled to less than 5 fathoms. Care should be taken in the north-east monsoon not to get into the bay to the east of Rameswaram island, as it is difficult to work out again.

Kundugal Point, the south-west point of Rameswaram island, between which and Shingle islets is the eastern channel to and from Pámbam pass, bears S. $\frac{1}{2}$ E. nearly 2 miles from the lighthouse. The extreme point, which is marked by a beacon, is low and sandy, but cocoa-nut plantations commence a short distance from it, and extend towards the town of Pámbam, and to the north-east. To the east of Kundugal point the coast consists of ridges of small sandhills covered with scrub and stunted bushes, and at a distance of 2 miles, is a *white* beacon, which marks the limit of the port in that direction.

TONITUREI (Ramen) POINT.—This narrow tongue of land is the southern point of Madura on the Indian coast, and is rather more than one mile west of Pámbam town. Toniturei temple stands $1\frac{1}{2}$ cables within the point.

Kathu Vallimuni reef lies off the north shore of Toniturei, and is $1\frac{3}{4}$ miles in length east and west, and $3\frac{1}{2}$ cables broad; it consists

principally of large patches of coral and rock, with several feet of water between them, and dries in parts, at low-water spring tides. There is a boat-channel about half a cable broad between this reef and the main.

PÁMBAM (Paumben) PASS bears about S.W. by S. distant 73 miles from point Calimere. This important channel between India and Ceylon, deepened and improved by blasting and dredging, leads the coasting craft from Palk strait to the gulf of Manár, close along the west end of Rameswaram island, where the town of Pámbam stands. The pass is 1,350 yards in length, and varies in width from 52 to 25 yards; the depth in the channel range from 10 to 14 feet at low water, but it shoals suddenly on both sides, so that great care is necessary in taking vessels through. It is easier of approach from the northward than from the opposite direction.

The principal rocky barrier through which the pass has been made extends in a nearly straight line from Toniturei point to Pámbam. On the west side of the pass it is named the Great dam, and consists of large masses of rock, having a flat surface, which were formerly portions of a causeway that extended from Rameswaram island to the mainland. The north face of the dam at low-water is steep-to, and presents a wall-like appearance, but the boulders are sufficiently separated to allow a free passage to the water at low tide. About 100 yards south of the Great dam, and parallel to it, is another rocky ridge termed the South dam, which shows partially at low water and extends half-way from the pass to Toniturei point. Eastward of the Pámbam pass is a ledge of rocks, evidently once a continuation of the Great dam; it is covered at high water, and there are several patches of rock to southward of it with varying depths of water between. At 300 yards from Toniturei point, which is at the west extremity of the Great dam, there is an opening in the rocks; it is, however, so small, and has such a rush of water through it, that even fishing canoes never attempt to pass through.

Buoys.—The northern entrance is marked by a *red* buoy, from which Pámbam lighthouse bears E. by S. $\frac{3}{4}$ S., distant $6\frac{1}{2}$ cables; and the Pámbam pass ball and tripod are in line. A chequered buoy also lies in the channel about one cable northward of the Great dam. The sides of the channel are marked by posts.*

Approach from Northward to Pámbam pass is clear of dangers; the land, however, in its vicinity is low, the only conspicuous object being the temple of Paruvadum, situated 5 miles E. $\frac{1}{2}$ N. from Pámbam. This is the first object seen from seaward, and is a good guide

* See Admiralty chart of Pámbam (Paumben pass), No. 69; scale, $m = 4$ inches.

for making the port; on a nearer approach to the entrance, the lighthouse forms an excellent mark. The northern entrance is shown by a red buoy.

The course to Pám bam passage from point Calimere is about S.W. by W., and the depths through Palk bay from $3\frac{1}{2}$ to 7 fathoms.

At night vessels may steer for the Pám bam passage with Pám bam light (visible 14 miles) bearing from S.W. to E.S.E., but should avoid getting into a less depth than 6 fathoms, especially near the coast of Rámesweram island. During the strength of the north-east monsoon (early in November to end of January), Pám bam passage should not be approached at night, it being then unsafe to anchor, owing to the short chopping sea which prevails.

Anchorage.—Vessels should anchor in 20 feet with the lighthouse bearing S. by E., distant about one mile, and Toniturei temple S.W. The holding-ground, mud, is very good.

PÁMBAM TOWN, situated on the western extreme of Rámeswaram island, consists principally of large-sized huts. There are but few Europeans, but of late years, as the traffic through the pass has increased, many native merchants have established themselves at Pám bam. The inhabitants are for the most part fishermen and boatmen, some of whom find employment in conveying coolies to Ceylon, and others in ferrying the pilgrims who visit the temple of Rámeswaram; there is also a large number of coolies employed in hauling vessels through the pass when the wind is adverse, sometimes as many as a dozen vessels being hauled through in one day. The value of imported goods in the years 1876–77 amounted to Rs. 10,22,22,72. The number of coolies annually passing through Kundugal averages about 36,000.*

Pám bam is the repeating station for all telegraph messages through to Ceylon. There are no docks or appliances at Pám bam for the repair of vessels; coal cannot be obtained, but firewood in large quantities is to be had.

Supplies.—Beef and mutton are not easily procurable, goat being the principal animal supplied in the bazár. Fowls and a few native vegetables may be had, fish is plentiful, and good water is easily obtained, but vessels have to use their own casks.

Pilots.—There are 13 licensed pilots at Pám bam, who are under the orders of the master-attendant. During the south-west monsoon, pilots are stationed on Pulli island, to look out for vessels making the port from southward.

* During the year 1877, the vessels belonging to the Ceylon Immigration Agency conveyed to and from Ceylon 152,000 coolies, and in the same year 47,000 pilgrims visited the temple of Rameswaram.

There are no anchorage nor port charges at Pámbam, but customs dues are levied.

LIGHT.—A *fixed white* light is exhibited at 97 feet above high-water, from a circular column of masonry, situated on a sand-hill about 40 feet in height, three-quarters of a mile eastward of Pámbam pass. The light is visible all round the compass, and may be seen 12 miles off in clear weather.

Kanthé Thuki reef, $2\frac{1}{2}$ cables west from Pámbam light-house, is composed principally of coral patches which partially uncover at low-water spring tides; it is $2\frac{1}{2}$ cables long north-east and south-west, by one cable broad. There is a channel for boats between this reef and the shore near the lighthouse, which is used by the pilots when going out to board vessels in the north-east monsoon.

Horse-shoe bank.—Southward of Pámbam pass is an extensive sand-bank, which, projecting from the west end of Ramesweram, bends round in the form of a horse-shoe to Toniturei point; the general depths over it are from 2 to 6 feet, and through the loop, at one and a quarter miles from the pass, Sand-bank channel has been dredged to the depth of 10 feet at low-water. A *red* buoy lies at each end of this channel. The beacons on Kúrisuddi island and reef in line, lead through.

Pulli, Pullivausel, and Kúrisuddi are three islands southward of Horse-shoe bank, which are completely encircled by a coral reef, the whole forming a natural breakwater that protects the pass and the channels leading to it from the swell of the south-west monsoon. The islands are low and covered with scrub and bushes.

Pulli is marked by a beacon 30 feet high and painted *white*.

Kúrisuddi, also marked by a beacon, is used as a quarantine station and there is a hospital and a few small houses on it. The space between the northern edge of the reef and Pámbam pass forms a sheltered anchorage for vessels of light draft in all weathers.

The deepest water between the above islands and Pámbam pass is westward of Mundel point, and is called the basin, over which there is an average depth of 18 feet, but in one spot is a depth of 21 feet. This basin is very narrow, being simply a hole scoured out by the water in rushing through the pass, and, consequently, of little value to ships, as it has the pass to northward, with only 10 feet, and Sand-bank channel to southward, also with 10 feet, at low water. Between Horse-shoe bank and Kundugal gut, is a flat, with a depth on it of from 10 to 12 feet.

Shingle islets, two small islets nearly $3\frac{1}{2}$ miles east from Pulli beacon, and $1\frac{1}{3}$ miles south-east from Kundugal point, are low, and have a few bushes and shrubs on them. A large beacon, 40 feet in height,

and painted *white* with a broad *red* band in the centre, has been erected on the eastern islet, and is a good guide to vessels making for the eastern entrance channel. An extensive reef surrounds these islets.

Two Fathom Patch.—There is a 2-fathom patch lying 4 miles S. by E. from Shingle islets, on which the sea breaks with a fresh breeze; the east port-beacon kept open of the beacon on Shingle islet leads clear of it. About $2\frac{3}{4}$ miles E. by S. $\frac{1}{4}$ S. from this patch is another having 3 fathoms over it.

SOUTHERN DANGERS.—MANAULI ISLET, lying 7 miles to the south-west of Pámbam lighthouse, is the easternmost of a number of islets, which, with their fringing reefs and intervening banks, lie at some distance off the Madura shore between Toniturai point and Tuticorin, thus sheltering a considerable extent of the northern waters of the gulf of Manár from the swell of the south-west monsoon, and affording convenient smooth water navigation for the coasting craft.

At $1\frac{1}{4}$ to 2 miles southward of the reef encircling Manauli and Musel islets, are several shoals having $2\frac{1}{2}$ to 3 fathoms water over them. One of these shoal patches, with $2\frac{1}{2}$ fathoms water, lies $2\frac{1}{2}$ miles south from Manauli, and 3 miles east from the southern elbow of the reef.

Manauli reef, extending 2 miles east of Manauli island, is about 7 cables broad, and consists principally of coral and rocky patches; it dries at low water spring tides.

Pulli Shoal, $1\frac{1}{2}$ miles S.S.E. from Pulli beacon, and lying in an E.N.E. and W.S.W. direction, is one mile in extent, and composed of sand and coral; the depths on it vary from 8 to 12 feet, but on its north-west part is a rocky patch with only 5 feet over it. The western edge of this shoal lies almost due south of Pulli beacon. With a moderate breeze the sea breaks on the shoal.

Pulli reef completely encircles the islands of Pulli, Pullivausel, and Kúrisuddi, and consists of rocky and coral patches; its northern edge is clearly defined at low water, but its southern, is much broken into patches, and the sea breaks continually over it.

A patch of rock lies to the southward of Kúrisuddi island, with Pámbam flag-staff and Kúrisuddi beacon in line, distant one mile from the latter, and has 7 to 8 feet water over it. Another rocky patch with 8 feet over it, lies mid-way in the channel between Kúrisuddi island and the north-west part of Kallarú reef. This passage is seldom used, as the bottom is foul and uneven, and, occasionally, heavy breakers extend the whole breadth of the channel.

Kallarú reef, encircling Shingle islets, extends one cable eastward, and $3\frac{1}{2}$ cables westward of them; it consists of coral and rocky patches, and the sea breaks heavily on its south and west edges.

INNER DANGERS.—Kana Parú reef, a coral patch, nearly $1\frac{1}{2}$ miles westward of the south extreme of Pulli island, extends in a north-west and south-east direction about 2 cables; the whole surface uncovers about one foot at low water.

Kolimuruka reef, awash at low water, lies about 7 cables W.S.W. from Kana Parú reef, and nearly the same distance from the northern edge of Maunuli reef; it is about three-quarters of a cable in extent, and lies in a north-east and south-west direction.

Heron Reef, less than one mile due west from Kana Parú, is about one cable long east and west, and is awash at low-water.

May Reef lies $4\frac{1}{2}$ cables north-east from Heron reef, and W.N.W. of Kana Parú; it is of small extent, half a cable across, and is awash at low-water.

Sunken Reef.—This dangerous patch lies one and a half miles north-west from Kana Parú reef, and about $1\frac{1}{2}$ miles S.S.W. from Mundapum point; its greatest breadth is three-quarters of a cable, and it never uncovers, having about one foot on it at low-water; it is not easily seen during rough weather.

TIDES.—It is high-water, full and change, at Pámbam, at 1 h. 50 m.; springs rise 3 feet. During neaps, sometimes for 48 hours, there is a rise of only one or two inches.*

The tides are irregular at Pámbam, the rise and fall being affected by the winds. During the north-east monsoon there is less water throughout the whole space southward of the pass, but in the south-west monsoon the reverse takes place, and the level of the water is higher or lower according to the force and continuance of the prevailing winds.

The flood stream enters between Kundugal point and Kúrisuddi island, and sets westward along the face of Pulli reef till it is joined by the stream setting in through Puma channel, thence it takes a northerly direction, but is weak except during strong winds.

The currents at Pámbam are generally influenced in strength by the force of the wind. Through the pass, the current frequently attains a velocity of from 5 to 6 knots, rendering it at times difficult to take even full-powered steam-vessels through. During the north-east monsoon the current sets to the southward, and in the south-west monsoon to the northward. The only months in which a decided tidal stream is noticeable, are March, April, and October, when it generally sets for six hours each way.

* The tides are subject to a diurnal inequality, which may accelerate or retard the times of high and low water, sometimes to the amount of one hour or more, and increase or diminish the rise by upwards of one foot.

WINDS.—During October, south and south-west winds prevail and occasionally blow strong; towards the end of the month variable winds are experienced, which last till the early part of November, when the winds sets in steady from northward and eastward, and, with few exceptions, blows strong for the remainder of the month. The wind during December is much the same as that of November, veering, however, more to northward, whilst heavy squalls of rain and wind are of constant occurrence. During January and February, the north-east wind is more moderate; it is light in the morning, but sets in strong about noon as a sea breeze, and falls again at sunset. March is one of the finest months at Pámbam, the north-east wind being light and variable. In the morning the wind sets in from eastward, having a tendency to veer to the southward, but by noon it backs to eastward, and lasts till sunset, when it gradually dies away. Occasionally south and south-west winds blow for a day or two, but the prevailing wind in March is from the north-east. April is a most uncertain month, the wind blowing from all quarters, no two days the same. Squalls of wind and rain are experienced, all tending to show the approaching change of monsoon. The south-west monsoon occasionally sets in during this month.

DIRECTIONS.—When approaching Pámbam from the southward, caution is necessary, as the islands fringing the coast are very low, and there are no hills or conspicuous landmarks to guide the navigator; during the south-west monsoon a thick haze frequently hangs over and obscures these low islands.

The first objects distinguishable from seaward are Pámbam lighthouse and the beacons on Pulli island and Shingle islet. On a sand-spit off the eastern end of Manauli island, 7 miles to the south-west of Pámbam, is a small white beacon; the reef off Manauli island extends 2 miles to eastward of it.

Vessels making for Puma channel, between the island of Pulli and Manauli reef, should be guided principally by the eye, as the reef off Manauli is clearly visible; it has deep water one cable off it all round, and the sea always breaks on its south and east sides. By keeping 2 or 3 cables to eastward of this reef, a N. $\frac{1}{2}$ E. course will lead a vessel clear of all dangers until abreast Pulli island, the least water being 16 feet. If bound for the pass, as soon as the beacon on Kundugal point is in line with the north-west point of Pulli island, haul in for the south buoy, which is moored off the north-west margin of Pulli reef, care being taken to pass close to the buoy, in order to avoid the 9-foot patch lying $2\frac{1}{2}$ cables westward of it.

In making for Puma channel from eastward, care should be observed not to shoal under 3 fathoms, so as to avoid Pulli shoal and the reef off Pullivausel, which extends $3\frac{1}{2}$ cables from its south point.

In making for Kundugal entrance channel, which is by far the best channel, vessels should not shoal under 4 fathoms till Pámbam lighthouse shows open eastward of Shingle islet beacon, when they may haul in for the east port-beacon, being careful not to approach the reef off Shingle islets nearer than 3 cables. As soon as Pulli beacon appears open northward of the beacon on Kúrisuddi island (care being taken not to mistake the small rock beacon for the latter), vessels may haul in for the anchorage off Kundugal, but the spit which extends from Kundugal point must be avoided.

Vessels approaching Pámbam from westward and passing between the islands and the coast of Madura, should, when abreast Manauli island, keep a good look-out for the reefs of Kolimuruka and Kana Parú, and in about mid-channel between them and Manauli reef. These reefs all show well, and have deep water close-to.

THE COAST of the western and northern sides of Palk bay is low and level, and extends in a double bight from the Pámbam pass to point Calimere, a distance of 73 miles. The southern bight forms the eastern shore of the province of Madura, the northern bight the south coast of Tanjore. The whole of this coast is without harbour or inlet, and is of commercial interest to native trade only. The river Vaigai, on which is the town of Madura, disembogues at Attankarai about 14 miles westward of the Pámbam pass. About 5 miles northward of Kottaipatam in lat. $9^{\circ} 59' N.$, a projecting low point terminates in a spit of sand, the shoal water from which extends E. by S. for about 15 miles, and thereby forms the double bight already alluded to. The 3-fathom line extends seaward from the west side of Palk bay for a distance of from 4 to 5 miles, the nature of the bottom consisting of sand and sometimes mud. A conspicuous column known as the Shallavenaikapatam pagoda, near a village of that name near the coast, 34 miles westward of point Calimere, which is visible from a distance seaward of 15 miles, is the most prominent landmark.

The ports of the Madura coast, which are no more than open anchorages, northward of the Pámbam passage, are as follows:—

Rameswaram (east side of the island), Pámbam, Pillaimadam, Emanagudu, Attankarai, Mudiapatam, Devipatam, Tirupalakudi, Karungudu, Pudupatam, Nambidalai, Tondi, Damodarapatam, Pasipatam

Devipatam, a coast town, 22 miles N.W. by W. of the northern entrance to the Pámbam pass, is an emigration depôt, from which, during the south-west monsoon, natives are conveyed to Manár island. It was formerly said to be populous, and contains several wealthy native merchants. Small vessels anchor in 2 fathoms, sand and mud, with the town of Devipatam bearing West, distant about 2 miles. During the north-east monsoon four sailing vessels of about 250 tons, which ply between

Devipatam and Manár island, are utilised between Pámbam and Vengalle in Ceylon, as at that period Devipatam has no safe anchorage.

Tondi or **Tandi**, another coast town in latitude $9^{\circ} 44' 45''$ N., is situated about 17 miles N.N.E. of Devipatam, and is of some commercial importance, trade being carried on by native trading vessels. Anchorage may be obtained here in 3 fathoms, mud, with the town of Tondi bearing W.N.W., distant $3\frac{1}{2}$ miles, but exposed to all winds with easting in them. Small vessels anchor nearer the shore in from 10 to 18 feet, stiff mud.

The ports of the Tanjore coast, few of which are important, are as follows, working from south to north. Sundarapandiam, the south limit of which is the north bank of the Sitar river, and the north limit the south bank of the Palliyar river. Kottaipatam, the south limit of which is the north bank of the Karúr river, and the north limit is the south bank of the Peyar river; Ammapatam; Kristnajipatam; Kattumavadi, the south limit of which is the north bank of the Ammayanor river, and the north limit the south bank of the Kattayanor river. Gopalapatam, the south limit of which is the north bank of the Kolwanár river. Adrampatam; Muttupetai, which is just eastward of Adrampatam, the sea custom cutcherry marking the boundary between them. Point Calimere, the port of which is considered to be south of the point, and is thoroughly exposed to the south-west monsoon. Thoputorai; Velangani; Negapatam and Nagar; Tranquebar; Cauverypatam or Kodimpalem; and Thirumalaval, which is the northernmost port of the Tanjore district.

Kottaipatam, a coast town, bears N.E. $\frac{3}{4}$ N., distant $17\frac{1}{2}$ miles from Tondi, and may be distinguished by a single tree and plantation of high palmyras. The best anchorage, about 3 miles from the shore, is in $2\frac{1}{2}$ to 3 fathoms, with the single tree and plantation of high palmyras in line, bearing W. by N.

A sand spit, with from one to 2 fathoms over it, stretches E. by S. for a distance of about 13 miles from a low point, which protrudes to the eastward, about 5 miles to the northward of Kottaipatam. A heavy swash of the sea generally prevails over this sand spit, which should not be approached from the eastward nearer than a depth of 6 fathoms. From a position in 3 fathoms off its eastern extreme, Pámbam bears S. 22° W. distant $44\frac{1}{2}$ miles, and point Calimere N. 50° E., distant $29\frac{1}{2}$ miles.

Tides.—It is high water, full and change, at the Sand spit, at 11h.; approximate rise and fall 15 inches.

Shallavenaikapatam pagoda,* in lat. $10^{\circ} 16' N.$ bears S.W. $\frac{1}{2}$ W. from Adrampatam, and is a high column situated near the coast, visible from seaward for a distance of 15 miles.

* Erected in 1814 by the Rajah of Tanjore.

ADRAMPATAM.—From the low protruding point from which the sand spit just described extends, the coast curves in to the northward for about 20 miles to the coast town of Adrampatam, from which place considerable native trade is carried on with Ceylon and the ports in southern India. Adrampatam is considered a port of refuge for native vessels between the months of May and September.

Anchorage in 20 feet, soft mud, may be obtained off Adrampatam, with the town bearing North, and Shallavenaikapatam pagoda bearing West distant 6 miles, but small vessels approach the coast much closer. With south or south-east winds a heavy swell sets on to this coast, rendering the anchorage insecure, but in the north-east monsoon it is considered good.

From the eastward, after having cleared the shoal water extending southward from point Calimere, and the shoals between that point and Ceylon, a good course will be W. by N. with Shallavenaikapatam pagoda right ahead, in about 4 fathoms, at a distance of about 5 miles from the shore, anchoring as convenient according to the vessel's draught.

The coast from Adrampatam trends E. $\frac{3}{4}$ S. for 29 miles to point Calimere, and consists of mud flats covered with mangrove bushes, the whole being overflowed during heavy rains and high spring tides.

POINT CALIMERE * forms the northern point of entry to Palk bay and the southernmost point of the Coromandel coast. A beacon erected in 1849 on the south-east extreme of the point, is now surrounded by water, owing to the encroachment of the sea. About $2\frac{1}{2}$ miles westward of the point are the Kodigeri bungalows, formerly much resorted to during the hot weather. At about $5\frac{1}{2}$ miles N.N.W. from the beacon, and a mile inshore, are two dark looking pagodas, in shape like oblong haystacks, which when in line bear West. A sand bank, dry at low water, extends about 2 miles N.E. by E. of Calimere beacon, inside which, trading boats find shelter in bad weather.

The coast bank surrounds point Calimere, having its 3-fathom edge as far seaward on the south-east side as 2 miles, and on the southern and western sides extending to a distance of $3\frac{1}{2}$ miles. There are also detached sand patches with less water in the vicinity, for the position of which, the seaman is referred to the chart.

In rounding point Calimere from the eastward, by the channel north of the Middle bank, and immediately south of point Calimere, the position of a vessel may be obtained by cross bearings of the two pagodas to the northward of the point, and of the beacon, prior to shaping

* Sometimes spelt Calymere, Kalimere, and Kalymer. A revolving light has been proposed for Calimere point.

a south-westerly course clear of the 3-fathom coast bank on the north side, and a detached 2-fathom patch on the south. A depth of more than 20 feet, cannot, however, be relied upon. Daylight is essential, and careful attention should be paid to the lead.*

THE COROMANDEL COAST † (a name of doubtful origin), is the term generally applied to the south-east part of the shores of the peninsula of Hindustán, between point Calimere on the south, and the mouth of the Kistna river on the north, a distance of about 365 miles. It is divided into the districts of Tanjore, South Arcot, Madras, Chengalpat, North Arcot, and Nellore. The whole coast is low and sandy, and exposed to a tremendous surf, the artificial harbour of Madras alone affording shelter for European shipping. To the north of Sadras (about 40 miles southward of Madras), the sea appears to have encroached upon the coast to a considerable extent.

The currents on the Coromandel coast depend greatly on the wind, and are at times very strong, ‡ generally setting to the northward during the south-west monsoon, and to the southward in the north-east monsoon (*see* page 19).

THE COAST from point Calimere trends N. $\frac{1}{2}$ W. for about 28 miles to Negapatam, is low, and fringed with groups of palmyra trees; § it should not be approached nearer than a depth of 7 to 8 fathoms, which will be found about 8 miles off shore. The two dark-coloured pagodas 5 miles northward of point Calimere, already alluded to, and a sand hill in about lat. $10^{\circ} 38' N.$, with a white house on the beach close to its north side, are the only distinguishable marks between point Calimere and Negapatam. This sand hill, bearing West, is a mark for clearing the north end of Negapatam shoal.

Negapatam shoal, composed of hard sand and stones, having over it less than 3 fathoms, is situated nearly 4 miles from the shore, in lat. $10^{\circ} 36' N.$ Between the shoal and the bank which fringes the shore the water deepens to 4 and 5 fathoms, thus forming a narrow channel, used by native boats; but vessels should avoid approaching this part of the coast nearer than in a depth of from 7 to 8 fathoms.

* The stunted brab trees marked on the chart westward of point Calimere and the flagstaff on the point were not recognisable in 1883.

† *See* Admiralty chart of Coromandel coast, sheet 4, Madras to Point Calimere, No. 71d; scale, $m = 0.25$ inch. Also, sheet 3 from lat. 13° to $15^{\circ} N.$, No. 71c; and sheet 2 from lat. 15° to $16^{\circ} 30' N.$, No. 71b.

‡ H.M.S. *Vigilant*, in August 1864, experienced a north-easterly set between Cuddalore and Madras of 3 knots an hour.

§ During the last 25 years extensive plantations of casuarina trees (a species of fir) have sprung up along the Coromandel coast.—(*Commander A. D. Taylor, late I.N.*)

Caution.—Steam vessels bound to Negapatam from the southward should not close the coast nearer than 7 miles, until Negapatam bears N.W. $\frac{1}{2}$ W.

DIRECTIONS.—In rounding Ceylon bound to Negapatam during the south-west monsoon in sailing vessels, keep in 18 or 20 fathoms when passing point Pedro, till the Nagar minaret is sighted. If the wind hang to the westward, it will be necessary to haul closer in, but the water should not be shoaled to less than 8 fathoms, and the lead must be kept going. The Nagar minaret should not be brought to the northward of N.W., nor Negapatam light to the north of W.N.W. $\frac{1}{2}$ W., until Negapatam shoal is closed.

In the north-east monsoon, it will be necessary to make the land to the northward or windward of the port, as the current then runs strong to the southward, and into Palk bay. Ships have found themselves unexpectedly, set into shoal water off point Palmyra.

NEGAPATAM or Nágapatnam, one of the first Portuguese settlements on the Coromandel coast, but which became Dutch in 1660 and English in 1781, is the principal seaport of the Tanjore collectorate. It is situated at the mouth of the small river Kaduveiyaru forming part of the Vedarániam canal, which extends for a distance of $35\frac{1}{2}$ miles to a salt swamp of that name; salt being stored in large quantities at Negapatam. The limits of the port are defined by boundary pillars.*

Anchorage off Negapatam is exposed to all but westerly winds, the holding ground, mud, is good, and the water between 4 and 5 fathoms shoals gradually. In bad weather, a short broken sea gets up. Vessels may anchor according to their draught of water and the state of the weather; in the fine season, with the lighthouse bearing from W. by N. to S.W. and, Nagar minaret from N.W. to N.W. by N. $\frac{1}{2}$ N., in $4\frac{1}{2}$ to 6 fathoms, will be found a good position. During the north-east monsoon it is advisable not to anchor in less than 5 fathoms, and in putting to sea from Negapatam during that season, it should be remembered, that the current runs strongly to the southward into Palk bay and towards the north coast of Ceylon; ships will therefore require a press of sail to enable them to clear the Ceylon coast.

Landmarks.—The minaret, 148 feet high, with four smaller towers, at Nagar, the lighthouse, and two chimneys of the South Indian Railway workshops, afford conspicuous marks for fixing a vessel's position when making Negapatam. St. Joseph College of the Jesuits (now closed) occupies the site of the old Black or China pagoda of the early sailing

* See plan of Negapatam and Nagar anchorages, on Admiralty chart, Madras to point Calimere, No. 71d.; scale, $m = 1.75$ inches.

directions ; there are also two large Hindu temples, one in the centre and one in the south-west part of the town.

LIGHT.—A white masonry pillar, situated near the custom house at Negapatam, displays at a height of 79 feet above high water, a *fixed white* light, dioptric, and of the fourth order, visible in clear weather at a distance from seaward of 14 miles over an arc of 180° , or from North through west to South. Signals are displayed from the lighthouse.

Tides.—It is high water, full and change, at Negapatam at 9h. 32m. Springs rise 2 feet ; neaps rise $1\frac{1}{2}$ feet, and range 1 foot.

Current off Negapatam does not appear to be affected by the tide, but to depend upon the direction and force of the wind, with which it generally sets.

River and Bar.—The filling of the river at Negapatam every year by the freshets, felt in July, causes an opening off the end of the jetty, which gradually works to the southward, as the river begins to fall. About December, a sand spit, forms, and gradually increases until early in July, when it nearly blocks the river's mouth. The changes described occur regularly. In very fine weather, ships boats can cross the bar without danger, although with the risk of a wetting ; a steer oar is indispensable. The entrance to the river at Negapatam mentioned in former sailing directions, about a cable south of the present mouth, has been blocked up, for the purpose of increasing the scour over the existing bar.

Trade is considerable, and consists chiefly of timber, betel nuts and spices, imported from the Straits Settlements, rice, cattle, earthen ware ; European piece goods and twists being exported in return, and also to Burma, Sumatra, Penang, and Ceylon. Average annual value of exports is about 500,000*l.*, and of imports 400,000*l.*

Communication by rail and telegraph exists with all parts of India. Emigrants and coolies leave in large numbers for the Straits Settlements, and coal and stores for the South Indian Railway, of which Negapatam is the terminus, are here landed. The British India Company's vessels call twice a week, besides other large steam ships, and the roadstead is generally well-filled with native craft. With Nagar, the population of Negapatam is about 48,500, nearly 20 per cent. of which are Labhays, half Arab and half Hindu in origin, who have developed a great capacity for trade.

Supplies.—Heavy repairs can be executed in the foundries of the South Indian Railway Company. Boats drawing 4 feet can unload at high water, at a crane situated on the bank of the river, one cable south of the lighthouse.

Coal in considerable quantities is kept in store. Fresh water is indifferent and scarce. There is a small civil hospital at Negapatam.

NAGAR (Nagore), situated $3\frac{3}{10}$ miles to the northward of Negapatam, on the south bank of the river Vettár (which connects with the Cauvery through the Vennaru), was made over to the English by the Rajah of Tanjore in 1778. It is remarkable for its mosque with four towers, about 90 feet in height, and minaret, 148 feet high, which is visible from seaward before the low coast appears, and has been already alluded to. An annual feast held here is largely attended by pilgrims. The population is chiefly Mahomedan, and there is a considerable trade carried on by native vessels with Burma and the Straits Settlements.

The Vettár river at Nagar is about one cable in width, but blocked by islets and shoals, and obstructed by a shifting bar, having over it about 4 feet, similar to that at Negapatam.

Anchorage, though open, affords good holding ground, and vessels can approach the shore nearer than at Negapatam. The north bank of the Vettár river defines the northern limit of the port of Nagar; to the south the port joins that of Negapatam.

Shoals.—Off Negapatam and Nagar are three small sandy shoals, lying in a north and south direction, nearly $2\frac{1}{2}$ miles from the shore.

From the northern shoal, 2 cables in extent N.E. and S.W., by $1\frac{1}{2}$ cables in breadth, having over it 30 feet with 34 feet around, Negapatam lighthouse bears S. 56° W., distant about 3 miles, and the Nagar minaret N. 62° W., distant nearly $3\frac{1}{2}$ miles.

The centre shoal is of small extent, and has over it a depth of 30 feet. From it Negapatam lighthouse bears S. 64° W., distant nearly $2\frac{3}{4}$ miles.

From the southern shoal, having over it 27 feet, Negapatam lighthouse bears S. 74° W., distant about $2\frac{1}{2}$ miles, and Nagar minaret N. 49° W., distant nearly 4 miles.

KÁRIKAL,* the capital of a French territory of 52 square miles, is situated on the north bank of the river Arselár, more than a mile from the beach, about 5 miles north of Nagar. The coast hereabouts is very low, with a few fishing villages. The rivers Koluncherri and Tirumali, both like the Arselár, barred streams, find their way into the sea between Kárikal and Nagar. These rivers can only be navigated after the heavy rains have sufficiently swollen their streams, when cargo may be landed in flat bottomed boats. Kárikal is a straggling town numbering about 92,000 inhabitants, of which about 200 are Europeans.

* Chiefly from remarks by M. Fribourg, late harbourmaster at Kárikal, published in French Hydrographic Notice, No. 12 of 1881.

Landmarks.—From the south, vessels should sight the high minaret of Nagar; from the north, the dome of the church and lofty flagstaff on a white pediment (generally flying the French flag), situated about $1\frac{1}{2}$ cables inland from the beach, on the north side of the river mouth, behind which is a white building with colonnades.

LIGHT.—From the flagstaff on the north side of the mouth of the Arselár river, at an elevation of 45 feet above high water, is exhibited a *fixed white* lantern light, which should be visible in clear weather from a distance of 8 miles.*

Anchorage off Kárikal is said to be the best on the Coromandel coast, the bottom, of muddy sand, affording good holding ground.

In the south-west monsoon, anchor in from $4\frac{3}{4}$ to 6 fathoms, with the flagstaff bearing W. $\frac{1}{2}$ S. During the north-east monsoon in $4\frac{3}{4}$ to 7 fathoms, with a long scope of cable, the flagstaff bearing West.

The current follows the direction of the coast, and varies according to the monsoon; the maximum rate reaching as much as 3 to 4 miles an hour.

Tides.—It is high water, full and change at Kárikal at 9h., ordinary rise 2 feet, springs rise $4\frac{1}{4}$ feet. At spring tides there is a depth of 8 feet at the mouth of the river.

Landing.—The lading and unlading of cargo is carried on with little difficulty in the river. The bar, which is marked by rollers, is very dangerous in the months of October, November, and December. Landing should not be attempted with ships' boats; there is a well-organized native boat service under the harbourmaster.

Signal.—A blue flag hoisted on the flagstaff at Kárikal indicates "the bar is heavy," and all communication prohibited.

Trade, consists of rice, cocoa-nut oil, sesame, coir, and piece goods as exports; the imports are sugar, sulphur, teak and sandal wood.

Winds and Weather.—The north-east monsoon begins in October, and terminates in March; the south-west monsoon begins in March and ends in October. The changes of the monsoon are almost always accompanied by bad weather. Cyclones are rare; they generally occur towards the middle of November and beginning of April. The rainy season commences towards the end of June, and ends at the latter part of November.

TRANQUEBAR purchased from the Rajah of Tanjore by the Danes in 1616, and bought by the English in 1845, is situated on the north bank of a river, navigable only for native boats, about $6\frac{1}{2}$ miles north of

* Kárikal light is said not to be powerful and that a vessel will have to keep in 10 fathoms in order to sight it.

Kárikal. The old fort of Dansborg and white houses with flagstaff and look-out tower, render it recognisable from the offing. A small grove of casuarina trees flanks the south side of the town. The sea has encroached considerably in this vicinity, and abreast the fort, protective stone groynes, which should not be approached too closely in boats, extend about a cable seaward.

Anchorage * may be had with Tranquebar flagstaff bearing W. by N., in from $5\frac{1}{2}$ to 6 fathoms, about $1\frac{1}{4}$ miles from the shore. At night, approaching from the southward, endeavour should be made to sight Kárikal light.

Landing.—Cargo is landed and shipped from the beach abreast the custom house in masula boats, carrying about 4 tons. During the north-east monsoon, there is about 6 feet at high water on the bar of the river, when native craft of about 150 tons enter for repairs.

Trade and Supplies.—The principal articles of export are twist, piece goods, coir, and spices. Poultry, bread, meat, and vegetables are procurable in small quantities. Fresh water for shipping is obtainable from the river during the freshes, from July to December.

Thirumalavasal or Tirmelwassel in the Tanjore district, about 13 miles northward of Tranquebar, is a small town with a pagoda situated near the mouth of a river which forms one of the many branches of the Cauvery. To the southward of Thirumalavasal, distant about 6 miles, is Cauverypatam with two pagodas. The land northward of this begins to rise slightly; it having been very low and flat between point Calimere and Cauverypatam.

COLEROON RIVER, the south boundary of the South Arcot district, discharges itself into the sea about 12 miles northward of Thirumalavasal. The whereabouts of the entrance may be detected by a thick plantation of trees, known as Coleroon wood, higher than the surrounding land, and which appears from seaward like an island. The four Chillumbrum pagodas, situated about 7 miles inland from the mouth of Coleroon river, in lat. $11^{\circ} 24' N.$, are remarkable buildings, but not seen when approaching from the southward until clear of Coleroon wood, on the bearing of W. by S. $\frac{1}{2}$ S.

Coleroon shoal, the inner part dry at low water, extends about $1\frac{3}{4}$ miles north-east of the entrance to Coleroon river, and has depths of 3 and $4\frac{1}{2}$ fathoms on its outer edge, with 11 and 12 fathoms close to seaward.

* Captain Higgins of the ship *Rozelle* remarks, April 10th, 1877. "Anchored at Tranquebar, mistaking the place for Kárikal, in $5\frac{1}{2}$ fathoms, bad holding ground, drove into 4 fathoms. Current (in April) to the northward, $1\frac{3}{4}$ miles an hour."

When the south Chillumbrum pagoda is in line with the south part of Coleroon wood, a vessel will be abreast of the south end of Coleroon shoal, which does not extend far from the shore; and when the Porto Novo flagstaff bears W. by N. she is clear of the northern and most dangerous part of the shoal.

Caution.—Coleroon shoal should be avoided by vessels coasting, attention being paid to the lead, and care taken not to come into less than 17 fathoms.

PORTO NOVO, a name given by the Portuguese, situated on the north bank of the Vellar river in latitude $11^{\circ} 30' N.$, bears about N.W. distant 4 miles from the outer edge ($4\frac{1}{2}$ fathoms) of Coleroon shoal. The depth of water on the bar of the Vellar, which is a broad shallow stream, is 3 feet at low water to $4\frac{1}{2}$ feet at high water spring tides. Cargo is landed here at a jetty opposite the custom house. Native craft enter the river for repairs. A depôt for salt is established at Porto Novo. The Danes and Dutch formerly had factories here, and the extensive iron foundry at present idle has been worked by more than one company; ore of a fine description being found in Coleroon river. Small supplies for shipping are obtainable at Porto Novo. A remarkable description of mat, from leaves of the wild pine apple, is made here.

Directions.*—Ships should not close the coast at night nearer than $3\frac{1}{2}$ miles, which will be in 17 fathoms, and in closing the anchorage from the southward Coleroon shoal should be avoided, and a depth of 12 fathoms maintained until the flagstaff at Porto Novo bears W. by N., then steer for the roadstead.†

Anchorage.—From about the middle of October to near the end of December, vessels should anchor about 3 miles from the shore in 9 fathoms. During the first burst of the north-east monsoon native craft avoid this port, in consequence of Coleroon shoal then being to leeward of the anchorage.

In the south-west monsoon vessels anchor about 2 miles from the land in 5 to 6 fathoms, with the southern of the Chillumbrum pagodas bearing S.W. $\frac{1}{4}$ W., and Porto Novo flagstaff W. $\frac{1}{2}$ N.

CUDDALORE,‡ on the backwater formed by the confluent estuaries of the Guddilam and Paravanur rivers, is the principal port

* A lighthouse has been proposed for Porto Novo.

† The chimney of the iron works at Porto Novo has fallen down and will not be re-erected.

‡ The flagstaff is on a high sandy hillock, with a white building and church showing south of it. The south end of St. David fort is visible from seaward through a gap in the casuarina trees. About 2 miles north of the flagstaff, a small white pillar on a sand hill, marks the north limit of the port. Strong cargo boats are used here, which go in and out of the river.—*Commander A. D. Taylor (late I.N.)*

of the South Arcot district, and bears about north, distant 13 miles from Porto Novo; the coast between being low, with occasional sand hills, appearing from the offing like small islands. To the northward of the town, distant about 2 miles, are the ruins of fort St. David. The bar of the Guddilam river has about 3 feet over it at low, and 5 feet at high water. Cargo boats discharge at a jetty up the river near the custom house. Vessels of 200 tons have occasionally entered the river for repairs; mud docks can be cut here by the natives for about 50 rupees.

Anchorage may be obtained in 5 or 6 fathoms, with Cuddalore flagstaff bearing W. by N., at about $1\frac{1}{2}$ miles from the shore.

Trade and Supplies.—Paddy, rice, indigo, hides, and ground-nut oil form the exports, and areca nut and pepper the chief articles of import. The value of exports is about 30,000*l.*; population about 41,000. The town is well laid out and considered healthy. Bread, meat, poultry, vegetables, fruit and water, are procurable for shipping.

PONDICHERRI,† or Punducheri, the capital of the French possessions in India and residence of the governor, is situated 13 miles to the northward of Cuddalore, in latitude $11^{\circ} 55' N.$ The town is divided into two parts, the White town and the Black town, separated from one another by a canal. The White town, having its streets shaded by avenues of trees and built at right angles to each other, is a model one, and possesses many fine buildings, the whole presenting a picturesque and imposing appearance from seaward. The district of Pondicherri has an area of 112 square miles, and about 156,000 inhabitants. The revenue is valued at about 40,000*l.*

“From the offing, Pondicherri may be recognised by the land on the north side and at the back of the town, being higher than in the neighbourhood of Madras or Negapatam. At about 4 to 6 miles northward of Pondicherri is some red land with a few trees, about 100 feet high facing the sea within the sand hills. Northward of this the shore is low, with sandhills about 30 to 40 feet high. The cathedral, standing 300 yards southward of the lighthouse, is conspicuous, having two square towers with a cupola on the west side. From March to May coasting steamers anchor in 6 fathoms with the cupola touching the right of the towers. In the north-east monsoon bring the cupola between the towers or behind the south tower, when at anchor. The flagstaff is situated between the lighthouse and cathedral.

At times there is almost a total absence of surf, and the roadstead is considered in this respect better than that at Madras; the authorities are civil and obliging. Market supplies are cheap, and there are no port dues levied. A screw pile pier, at which ships' boats can land during the fine season,

* See plan of Pondicherri on Admiralty chart, No. 71*d*, scale, $m = 2$ inches.

has been constructed for landing and discharging cargo. The quarantine and port rules are stringent.

LIGHTS.—From a white masonry tower, near the beach at Pondicherry, is exhibited at an elevation of 89 feet above high water, a *fixed white* light, visible in clear weather from a distance of 15 miles.

From a mast at the extremity of the landing stage a fixed *red* light is shown at a height of 31 feet above the sea, visible in clear weather 4 to 5 miles.

When the surf is heavy and approach to the landing stage prohibited, a fixed *green* light is exhibited from an elevation of 26 feet, visible from a distance of about 3 miles.

Anchorage.—In the north-east monsoon, vessels should anchor in 8 to 9½ fathoms, about 1¼ miles from the shore, with the lighthouse bearing W.N.W. to N.W. by W., and ride with about 70 fathoms of cable. Precautions should be taken against bad weather.

In the south-west monsoon anchor in 7 to 8 fathoms, with the lighthouse bearing W. by N. to N.W., at the distance of about a mile from the shore. The sea at this time is generally smooth, but a long scope of cable is recommended, as the wind from the south-east occasionally prevails with considerable strength. In the changeable squalls there is danger of vessels colliding; a secure and open berth should therefore be selected.*

Tides.—It is high water, full and change, at Pondicherry at 8h. 25m. Springs rise 3½ feet and neaps 2¼ feet.

The current near the land follows the direction of the coast, setting to the southward during the north-east, and to the northward during the south-west monsoon, and at times attaining a velocity of 3 miles an hour. The current becomes less strong as the shore is receded from, so that in working against the wind, a vessel should stand some distance out from the coast.

Signals.—A printed code of bad weather signals is supplied to all ships. In case of a vessel not answering signals made to her from the port, attention is drawn by guns being fired. The signal for a boat is answered by a blue pennant at the port office. The commercial code is that in use. Both the town flagstaff and that at the port office are used for signalling purposes.

Monsoons.†—The south-west continues from about the middle of March to October, the north-east from about the middle of October until

* Steam vessels calling for coal at Pondicherry, anchor nearer the shore in the fine season with the southern coal shed (covered with red tiles) bearing between West and W. by S.

† From information by Mr. Hostein, captain of the port, originally published in *Annuaire des Etablissements Français de l'Inde*, 1872.

March. The season of gales begins in October, and lasts to the end of December. In January, the sky is usually clear, and the north-east wind fresh; in February the wind draws more to the eastward until the middle of March, at the end of which month, it blows from south-east by day and south-west during the night.

DIRECTIONS.—During the north-east monsoon (October to March), sailing vessels from the southward should keep near the middle of the bay of Bengal until they make the coast in the latitude of Sadras ($12^{\circ} 30' N.$), the locality of which may be known by the hilly land behind it; thence they can easily run down the coast to Pondicherri, keeping in 12 to 15 fathoms. Gales at this season are not unusual at Pondicherri; they generally begin at N.W., making the round of the compass through north or the same way as that in which the hands of a watch travel. Vessels are thus enabled to get away from Pondicherri to the south-eastward. After a gale the wind generally veers round to south-east, and fine weather prevails.

During the south-west monsoon, vessels from the southward should make the coast in the vicinity of Kárikal or Tranquebar, and whilst steering northward to Pondicherri remember the northerly set of the current. At this period the land wind is sometimes very strong and gusty, and changes rapidly in direction and force, but seldom lasts long.

Supplies and Landing.—Supplies for shipping can be obtained at Pondicherri. There is a resident British consul. Landing should not be attempted in ships' boats. The small river which flows through the town admits native craft only.

Communication.—Various lines of French steam vessels call at Pondicherri, and those of the British India Company fortnightly. The electric telegraph connects it with the Indian system.

THE COAST from Pondicherri continues its N. by E. $\frac{1}{2}$ E. trend for 6 miles, and then takes the direction of N.E. by N. for 31 miles to the mouth of the Palar river, which is a considerable stream, draining a large tract of country, and receiving many tributaries, but like the other rivers on this coast, has a bar at the entrance, which is completely closed in the dry season. The nature of the country continues low and sandy, except at from 4 to 6 miles northward of Pondicherri, where there is some red land about 100 feet high, dotted with trees. The Allamparwa river with a fort in ruins, and a thick grove of lofty casuarina trees, forms a dark conspicuous object at night. The north side of its mouth, which is barred, enters the sea 22 miles northward of Pondicherri.

The coast bank between Pondicherri and the mouth of the Palar river, has depths of about 5 fathoms at the distance of a mile from the beach,

and the 10-fathom line skirts the coast with seeming regularity, averaging distances therefrom, of from $2\frac{1}{2}$ to 5 miles.

Chengalpat (the brick town) district, between lat. $12^{\circ} 13'$ and $13^{\circ} 54'$ N., though having a seaboard about as long as Nellore, has only three ports, Covelong, Ennore, and Pulicat, besides that of Madras. The reason is that the boat traffic is carried on coastwise with Madras by means of a canal and backwater ; consequently there is little sea-borne traffic.

Palar river, the entrance to which is in about lat. $12^{\circ} 28'$ N., has a bar, the breakers of which extend nearly half a mile seawards. A plantation of lofty cocoa-nut trees stands on the north side of the river, and a thick wood of palmyras trees stands at the back of the sandhills midway between Allamparwa and Sadras.

SADRAS, from which the trade has completely fallen away, although in former years a flourishing Dutch settlement, is situated 5 miles N. by E. of the mouth of the Palar river, in lat. $12^{\circ} 32'$ N. The town, which lies low, is almost completely hidden from seaward by trees ; there is also a ruined fort.

Sadras hills, in lat. $12^{\circ} 37'$ N., bear N. 50° W., distant 8 to 10 miles from Sadras town, and are of irregular outline and not difficult to recognise. The south-eastern peak of the cluster is termed Finger peak, on account of the appearance of the temple on its summit.

THE COAST from Sadras continues to trend N. by E. $\frac{1}{2}$ E. for nearly 17 miles to Covelong, northward of which it recedes slightly, and then extends for 18 miles in a N. by E. direction to Madras.

TRIPALÚR REEF,* having rocks awash at low water, extends for about a mile from the shore in lat. $12^{\circ} 37'$ N. The Sadras hills bear West from this danger, which should not be approached nearer than in 13 fathoms.† On the shore, abreast the Tripalúr reef, are the seven pagodas of Mahábalipur. They are granite mounds, one of which, built on a rock, is conspicuous, the remainder are more or less screened by trees, and cannot be considered satisfactory landmarks.

* The Madras Government have intimated an intention to place a 4th order, dioptric, fixed white light, upon the pagoda standing on a cliff abreast of Tripalúr reef.—(Commander A. Carpenter, R.N., in charge of India Marine Survey, April 1886.)

† Commanders of vessels navigating between Sadras and Covelong are warned not to come within 13 fathoms, as there is reason to believe that there are dangerous outlying patches of rock to the northward of Tripalúr reef. (Master Attendant, Madras, 21st January 1886.)

Captain Barclay, of the ship *Bulmer*, is said to have carried soundings of from 5 to 7 fathoms on a bank in lat. $12^{\circ} 26'$ N., with Sadras hills bearing W. by N., distant from the nearest shore about 10 miles ; the same navigator is said to have had only 4 to 6 fathoms on another bank, in lat. $12^{\circ} 45'$ or $12^{\circ} 47'$ N., and about 14 leagues off shore which seems almost incredible. (*Horsburgh, Vol. I., p. 587, eighth edition, foot note.*)

COVELONG,* in lat. $12^{\circ} 47' 30''$ N., is a village situated near the south bank of a river which here finds its outlet into the sea, and which connects with Sadras by backwater, and with Madras by canal. The whereabouts of the village may be distinguished by a church and a few European bungalows, this place having been more resorted to in former years. There is also a Government salt depôt, and vessels sometimes load with that commodity for Calcutta. A conservator, who is the superintendent of customs, is resident at Covelong.

Tripalûr hill, its summit crowned by a temple, is situated S.W. $\frac{1}{2}$ S., distant 5 miles from Covelong.

Covelong point is prominent, situated south of the fort and village, and has a young plantation of casuarina trees, and some projecting rocks awash, extending nearly half a mile north-eastward from it, forming a small bight, in which there is landing for ships' boats during the south-west monsoon. In passing Covelong point, bound to or from Madras, the lead should be frequently cast, as the soundings have been reported irregular in the vicinity, and the depths found suddenly to decrease from 7 to $4\frac{1}{2}$ fathoms, owing to stone ballast having been thrown overboard from ships in former years.

Anchorage in 7 fathoms may be obtained with Covelong bearing W. $\frac{1}{4}$ N., distant about $1\frac{1}{2}$ miles from the shore.

Landmarks.—Between Sadras and Madras, about 6 miles inland from the coast, are the Pallavaram hills, about 3 miles north-east of which stands St. Thomas' mount, which bears S.W., distant about 8 miles from Madras. It is 120 feet above the sea, and in approaching Madras from the southward, may be recognised by the flagstaff, church, and buildings on its summit. Two miles nearer Madras, is a smaller elevation, known as the Little Mount.

MADRAS,† the capital of Southern India, standing close to the sea on a low and sandy coast swept by a strong current and exposed to a heavy surf, is unfavourably situated either for commerce or the requirements of a capital.‡ Its railroads and artificial harbour however, obviate some of the natural disadvantages it labours under, and it ranks third among the ports of India in respect of its maritime trade. The approach from the sea presents low flat sandy shores to the north and south, with a few small hills inland, and exhibits a striking appearance of barrenness, but the prospect improves on

* In 1878, it was contemplated to erect a flagstaff at Covelong.

† See plan of Madras roadstead, scale, $m = 3$ inches, on Admiralty chart No. 71c.

‡ The first English factory in the Carnatic was erected in 1628 at Armeghon, 56 miles to the northward of Madras. Its chief, Mr. Francis Day, in 1639, proceeded to build fort St. George on its present site, which became speedily surrounded by a town.

closer inspection. The town which stretches along the shore, and with its suburbs, covers a distance of nearly 8 miles, and runs $3\frac{1}{2}$ miles inland, numbers about half a million inhabitants, and is the seat of the governor and council of the Presidency of Madras, which comprises that part of the Hindustán peninsula lying south of the Kistna or Krishna river, together with that part of the Deccan known as the Northern Circars and Canara. Fort St. George, in the middle of which stands the original fort first erected in the settlement, but now chiefly used for Government offices, though not proof against modern artillery, is a strong handsome fortress which rises within a few yards of the sea. To the south of the fort stands the first built church, and to the north the Exchange and lighthouse. The Choultry plain commences about $1\frac{1}{4}$ miles south-west of fort St. George, from which it is separated by two small rivers, and situated in it is the Government house. About 7 miles further to the south-west, is St. Thomas' mount, at the foot of which is the military cantonment of the same name. There are consular agencies for all the principal states of Europe. Madras is the centre on which all the great military roads converge, as well as the terminal station of two lines of railway.

LIGHT.—On the esplanade, about 2 cables northward of fort St. George, is a granite tower 124 feet high, from which is exhibited, at an elevation of 128 feet above the sea, a *white light flashing* about every 2 minutes; the proportional time of light to darkness being as 2 to 3; visible in clear weather from a distance of 20 miles.

MADRAS HARBOUR,* commenced in November 1875, and in 1885 almost completed, is formed by two breakwaters, each about 7 cables in length, extending for about $4\frac{1}{2}$ cables at right angles from the shore, and then curving towards each other, leaving a passage nearly a cable in width leading to the enclosed area of about 200 acres of water, averaging in depth from 3 to 7 fathoms. When finished the harbour is expected to accommodate from 13 to 14 ships of large draught, beside smaller vessels.

A pier† 1,350 feet in length, with a T shaped head, projects from the shore about midway between the two inner ends of the harbour breakwaters. At its extremity is a depth of $3\frac{1}{2}$ fathoms. Ships' boats can ply

* The sea face of the breakwater at Madras has not[‡] been repaired since the cyclone in 1881. During our stay, the surf breaking on the beach within the breakwater, was almost as heavy as that without. Only seven vessels can be accommodated inside at present.—(Remark Book of Lieut. H. Predy, R.N., H.M.S. *Turquoise*, September 1885.)

† It is contemplated to exhibit a *fixed red light* at the end of Madras pier, but up to September 1884 this had not been accomplished. Owing to the works being damaged by the sea, harbour lights, formerly shown, from the northern pier head, had also been discontinued.

to and from the pier in safety except in bad weather when a masula boat* should be employed. Railway lines are laid along the pier, which has facilities for landing passengers as well as cargo.

When the harbour is full, steam vessels are admitted in rotation as they arrive, using their own anchors, cables, and stern fasts; in case of emergency arising, requiring them to leave suddenly, during the north-east monsoon, they are required to keep steam up.

Regulations.—No vessel is allowed to enter or leave Madras harbour without a pilot or harbour master unless authority to that effect has been given in writing by the conservator of the port. Vessels about to leave are to hoist flag N (commercial code) at the fore, and if about to enter, flag F of the same code. No more than one vessel may leave or enter the harbour at the same time.

Two buoys, painted red and white in vertical stripes, moored near the end of the breakwaters, indicate the harbour entrance.

Pilots.—Steam vessels arriving at Madras should not approach the entrance of the harbour too closely, but wait for a pilot in not less than $9\frac{1}{2}$ fathoms of water.

At night, vessels should anchor in 10 fathoms until daybreak.

ANCHORAGE.—Madras road is open to all winds except those from the westward or off the land, and there is generally a swell tumbling in from seaward, making vessels labour or roll considerably. A good position for a large vessel to anchor in is 9 fathoms, at 2 miles from the shore, with the flagstaff of the fort bearing West or W. by S. The bottom in many places is stiff mud, from which it is difficult to extricate the anchors. In the bad weather season anchor well out, and keep all ready to proceed to sea at a moment's notice, for the gales generally commence at N.W., blowing strong from the land, with which an offing can be gained before the wind veers to the N.E. and East, when it would be impossible to do so.

Vessels are prohibited from anchoring in any part of Madras roadstead southward of the line of the lighthouse bearing West, in order to prevent injury to the submarine telegraph cable. All sailing vessels,

* Masula boats of native construction, adapted for the surf, are capable of carrying about $1\frac{1}{2}$ tons. The surf at Madras breaks at 300 feet from the shore in fine, but at 450 feet in squally weather. During gales from the eastward it is said to break at a distance of 1,000 feet from the beach. Landing is more dangerous than embarking. The natives are skilful and there is seldom an accident. There are two lines of surf between which it is possible for a boat to remain without crossing either, the outer of these, or male surf, is the most formidable. With the land wind off shore the surf is often very high, but at that time there is only one slow heavy roller. In ordinary weather the surf wave is 2 to 4 feet high, in rough weather 6 feet, and during a gale 12 to 14 feet.

except coasting craft, should anchor beyond the depth of $8\frac{1}{2}$ fathoms outside the line of the buoys, which are painted red and white in vertical stripes, and are moored as danger buoys, and are not to be passed inshore of, nor the attempt made to pass between these buoys and their respective pier heads.* No vessel should come into less than 9 fathoms at night.† No ballast may be thrown overboard in the roadstead in less depth than 12 fathoms.

BAD WEATHER.—From the 15th of April to the 15th of June, and from the 1st of October to the 31st December sailing vessels are prohibited from anchoring in less than 9 fathoms, and are compelled to have their topgallant masts struck. Gales have occurred in April and May, but are not frequent, and if a vessel is ready to weigh or slip, and run to seaward at the approach of a gale, there is little danger to be apprehended; but vessels remaining at anchor are likely to be driven on shore. A scope of cable of at least 60 fathoms is recommended, a second anchor should be ready for letting go, and anchors should be buoyed. The limits of the port are marked to the north and south by boundary pillars, and extend to the east to a depth of 10 fathoms.

DIRECTIONS.—From February to September, sailing vessels bound to Madras should endeavour to make the land to windward or to the southward, sighting the Sadras hills on account of the strong northerly current then prevalent.

From September to the end of January the land should be sighted to the northward, Kettle Bottom hill in latitude $13^{\circ} 25' N.$, about 30 miles westward of Pulicat is said to be a good mark at this period, or at night

* The following system of buoyage in Indian waters is being gradually introduced in all ports and their approaches, Bombay harbour and Húgli river excepted :—

The side of the channel is to be considered starboard or port, with reference to the entrance to any port from seaward. The entrances of channels or turning points will be marked by *conical* buoys, with staff carrying globe, or triangle, or basket—*black* buoys on starboard side of the channel, *red* buoys on port side.

The sides of channels will be marked as follows :

Conical buoys, painted *black*, will mark the starboard side; *can* buoys, painted *red*, will mark the port side. Where a middle ground exists in a channel, each end of it will be marked by a *conical* buoy, coloured *red* on one side, *black* on the other, with a double beacon, either of basket and globe, or basket and triangle, as may be desirable.—In case of this middle ground being of such extent as to require intermediate buoys, they shall be of shapes and colours as on the sides of a channel.

Wrecks will continue to be marked by *nun* buoys coloured *green*. Fairway buoys will be *conical*, and chequered *black* and *white*.

Where channels are named in large rivers, as the Húgli, the initial letter of the channel's name, preceded by the letter L. for Lower, C. for Central, or U. for Upper may be painted on the buoys. Isolated sunken rocks will be marked by *conical* buoys coloured *red*.

† In a greater depth than 9 fathoms renders a vessel liable to extra boat hire; and if in more than 10 fathoms, outside the limits of the port.

the fixed white light of Pulicat. Approaching Madras from the northward, vessels should not bring Madras flashing light to bear to the southward of S.S.W. $\frac{1}{2}$ W., nor come under 15 fathoms by day, nor 20 fathoms by night.

Tides.—It is high water, full and change, at Madras, at 8h., 35m., springs rise 3 ft. 7 ins., neaps 2 ft. 4 ins. The tides are subject to diurnal inequality which may retard or accelerate the times of high and low water, and increase or diminish the rise by as much at times as one foot.

TIME SIGNAL.—About 1,300 yards northward of the lighthouse at Madras is the master attendant's office, from the flagstaff on the roof of which, a semaphore is dropped at 8h. a.m., Madras mean time, equivalent to 14h. 39m. 00·6s. Greenwich mean time; and again at 2h. p.m. Madras mean time, equivalent to 20h. 39m. 00·6s. Greenwich mean time.* When the semaphore drops incorrectly, the word (C.V.N.J.) *failed*, in the commercial code is hoisted, and kept flying for half an hour, and the semaphore lowered by hand. The semaphore is extended at right angles to the staff 5 minutes before the signal is made.

WIND, WEATHER, AND CURRENT.—The following table of wind, weather, and current prevalent on the Coromandel coast applies more particularly to the neighbourhood of Madras:—

Months.	Wind.	Force.	Current.	Force.	Remarks.
January -	N.E. to E.N.E. veering to East.	Steady and fresh.	South-west-erly.	1 to 2 knots.	At middle and end of January land and sea breezes at northern part of the bay of Bengal.
February -	N.E. veering to S.E. and South.	Light.	South-west-erly in early part of Feb., towards end of month begins to set to north-ward.	Weak.	Out in the bay of Bengal strong current to south both in January and February.
March and April.	S.S.E. to S.S.W. decreasing at sunset, and succeeded by land winds from S.W. to W.N.W.	Strong. } Not strong nor steady.	North-east-erly following direction of coast.	Strong at times 3 knots an hour.	In April, squalls occasionally from the N.W.
May -	South to S.W. veering towards the land at night.	Abating in strength.	North-east-erly.	At times 1 to 2 knots.	In May north-east winds often experienced, ending at times in a cyclone. Barometer should be watched, especially if wind set in at N.N.W. veering to North. At night (early part) squalls off the land from N.W.

* Allowing Madras observatory to be in long. 80° 14' 51" 3 E. To this observatory all Indian longitudes are referred, it stands about 2 $\frac{1}{4}$ miles S. 65° W. from Madras lighthouse.

Months.	Wind.	Force.	Current.	Force.	Remarks.
June -	S.S.W. to W.S.W.	Steady and increasing.	North - easterly in early part of month, but begins to set to southward inshore at latter end.	Weak. Weak.	In June S.W. winds along the Coromandel coast, and over the bay of Bengal generally.
July and August.	S.W. to W.N.W. and West.	Strong, with rain and overcast sky.	South - westerly or contrary to the wind.	Strong 2 to 3 knots at times.	By keeping inshore, in July and August, vessels from north to south have made good passages.
September	W.S.W. to West and W.N.W.	Decreasing in strength.	South - westerly.	Strong.	In September, N.E. winds sometimes for two or three days together.
October -	W.S.W. to N.W. then calms. N.E. towards end of month.	Light. At times light, at others strong, with rain and cloudy weather.	South - westerly.	Not strong.	October an uncertain month liable to cyclones. A very low barometer does not always accompany strong winds. A stormy sky should not pass unheeded.
November and December.	N.N.E. to N.E.	Strong and steady.	South - westerly, and to southward.	About 1 knot an hour.	November and early in December unsettled. Caution necessary. Hurricanes and cyclones often occur in November, and even in early December.

CYCLONES.—The Madras cyclones usually commence at from N.N.E. to N.N.W., the wind changing to the eastward or westward as the port may be left in the right or left hand semicircle of the storm. They generally travel from S.E. to N.W. or S.S.E. to N.N.W., but occasionally come in upon the coast from E.S.E., their rate of travelling being generally from 4 to 5 miles an hour. It often happens that a cyclone is ushered in with a N.W. wind. Local experience at Madras shows that the theory of allowing 10, and even 12 points to the right hand, for the bearing of the storm's centre is correct, and not 8 points.

Steam vessels proceeding to sea from Madras, in case of an expected cyclone, should steer from N.N.E. to N.E., steaming full power for 60 miles, and then heave to on the starboard tack, or keep head to wind, as the vessel will under the circumstances be in the right-hand semicircle of the storm, and on its advancing quadrant.

Sailing vessels should have best sails bent, and top-sails and courses close reefed. The ground swell has invariably the tendency to cast a vessel inshore on parting or slipping, and as this is a dangerous contingency, precaution should be used to have a spring on the cable to cant the ship's head seaward. With a N.W. wind at Madras, the centre of the storm would bear about east, distant 80 to 100 miles. A vessel should therefore stand S.S.E. (not S.E.) or along the coast until in the latitude of

Pondicherri or Cuddalore, and then heave to on the port tack, thus obtaining a clear drift first to the eastward, and then with the rapid shifting of the wind to the westward, back to port. But to carry out these directions a vessel should leave early in the storm; in fact, on seeing or hearing the signal that a storm is approaching, at once, as every hour is of importance.

Vessels in ballast, or discharging cargo such as iron, timber, &c. had better shift out into 11 or 12 fathoms of water on the approach of a gale, and have two anchors down, veering as much cable as possible, striking upper masts and yards, and securing cargo from shifting. This method of riding out a cyclone has been successfully accomplished.

WEATHER SIGNALS.—The following are hoisted at the master attendant's flagstaff :—

White flag with blue cross	- Weather suspicious. Prepare for putting to sea.
Red flag with swallow tail, followed by 7 guns from the fort, at intervals of 5 minutes between each discharge.	- Cut or slip.
At night, Three lights—one at masthead and one at each yardarm of flagstaff—followed by 7 guns with intervals of 5 minutes.	- Indications of an approaching gale.

All signals should be answered by a pennant during the day, or a light at the peak during the night. In case of fire, distress, or emergency, guns should be fired and blue lights burnt.

Boat Signals.—Government recall flag for a vessel leaving Madras is the English red ensign at the master attendant's flagstaff. A white pennant with red centre (C of commercial code) is the recall flag for all boats. A Union Jack should be hoisted at the fore when an accommodation boat is required, a wheft for a cargo boat, and flag B. of commercial code for a catamaran; Union Jack under the red ensign for the police boat.

Trade.—The value of exports and imports of Madras is about fifty million rupees. The former consist chiefly of coffee, cotton, colouring materials, piece goods, grain, hides, indigo, seeds, raw silk, &c.; the latter of haberdashery, arms, coral, twist, piece goods, drugs, glass, grains, liquor, metals, silk, timber, &c.

Supplies are easily procurable. Fresh water is laid on by pipes to the end of the pier from the "seven wells" (two only now in use yielding about 260,000 gallons a day) at the north end of Black town; it is charged for at 4 rupees 4 annas a ton, if brought alongside, and is pure. There is a general hospital and a marine surgeon who attends emergent cases on board.

Coal can always be obtained.

Communication.—Madras is connected with the Indian railway and telegraph systems. Numerous steam vessels call here, including those of the Peninsula and Oriental, and British India Cos. ; the latter once a week.

Climate.—The general character of the climate of Madras is dry and hot, and the temperature is high all the year round. The mean temperature in the shade ranges between 74° and 87° F., the extremes being 67° in January and 93° in June.

Rainfall.—At the change of the monsoon from S.W. to N.E., which usually commences early in October, there is generally a slight fall of rain amounting to over 11 inches in the course of two or three weeks. This is termed “the first” rain. A month later “the second” rain begins, and is rather less in the same period. Sixteen inches of rain are ordinarily registered at the observatory. These two rains constitute the latter rains and yield about 28 inches. In the months of July and August there are occasional heavy rain showers. The entire annual rainfall of Madras amounts to about 50 inches, but in exceptional years it has been known to fall as low as 30 inches, and on the other hand to amount to as much as 80 inches.

THE COAST.—About 3 miles northward of Madras, plantations of casuarina trees commence, and extend to Ennore ; a dense high tope of these trees stands about midway between the two places.

ENNORE is situated nearly 9 miles N. by E. $\frac{1}{2}$ E. from Madras, at the mouth of an extensive backwater, which here finds its way into the sea. Ennore, which is connected by canal and carriage road with Madras, is resorted to by the European community of Madras. Salt is obtained here, but is a Government monopoly. Vessels bound to Ennore must enter and clear at Madras.

Anchorage off Ennore may be had in $6\frac{1}{4}$ to 7 fathoms, about 7 cables from the shore, with a house on the north bank of the river on a sandy elevation bearing N.W. by W. and the tiled bungalows on the beach on the south bank of the river, W.N.W.

Ennore shoal having over it from one to 3 fathoms, extends in a north-easterly direction for $2\frac{1}{2}$ miles from the coast, immediately northward of Ennore.

Caution.—Vessels should not bring Madras light (flashing white) to bear southward of S.W. by S. $\frac{1}{2}$ S., or approach the coast in the vicinity of the Pulicat shoals nearer than a depth of 20 fathoms by night, nor under 15 fathoms by day.

PULICAT SHOALS consist of hard sandy patches having over them depths of from $2\frac{1}{4}$ to $3\frac{1}{4}$ fathoms, the northernmost of which, having $3\frac{1}{4}$

fathoms, lies about $9\frac{1}{2}$ miles N.N.E. of Ennore, with Pulicat lighthouse bearing N. 67° W. distant $4\frac{1}{2}$ miles. For details connected with these shoals the chart is the best guide; passages exist between the shoals, but local knowledge is necessary to enable a vessel to take advantage of them. With Pulicat lighthouse in line with Kettle Bottom hill bearing West, a vessel will be to the northward and clear of the Pulicat shoals.

A shoal, upon which the steam vessel *Clan Macintosh* obtained 4 fathoms, is stated to lie with Pulicat lighthouse bearing N.W. $\frac{1}{4}$ N., and Madras lighthouse S.W. $\frac{3}{4}$ S., or in about lat. $13^{\circ} 18' N.$, long. $80^{\circ} 25' 30'' E.$ Mariners are warned not to approach this part of the coast too close until an examination of the locality has been made.*

THE COAST between Ennore and Pulicat, a distance of 11 miles, protrudes slightly, trending a little to the westward, and is covered with plantations of the casuarina tree. Inland, distant from 30 to 40 miles from the coast, are the Nágari hills, near to which is a remarkable table land, known as Kettle Bottom, which bears nearly due west from Pulicat lighthouse. About 6 miles south-west of Kettle Bottom is a sharp hill with crooked summit, not so high as Kettle Bottom, and known as Nágari Nose.

PULICAT, 11 miles northward of Ennore, stands on an island at the south end of Pulicat lake, a salt water lagoon about 36 miles long and from 2 to 10 miles broad, which forms part of the inland water communication of this part of the coast, and is connected with Madras by Cochrane's canal. The lake is separated from the sea by a low sandy beach, through which there are some openings, and is supposed to have been formed by the sea breaking over the low coast during a cyclone. Pulicat is generally considered the southern limit where the Telugu language is spoken. The earliest settlement of the Dutch in India in 1609, it came into the possession of the English in 1795. The population is about 5,000. Of late years the trade has declined; formerly with the Straits Settlements it was considerable.

LIGHT.—On the narrow sandy peninsula opposite Pulicat and on the site of the former flagstaff, is a tower 57 feet high, painted in alternate horizontal bands of black and white, from which is exhibited at an elevation of 68 feet above the sea, a *fixed white* light, visible in clear weather from a distance of 14 miles.

Anchorage.—Vessels bound to Pulicat anchorage from the southward should pass outside the Pulicat shoals, and keeping the lead going, not come into less than 15 fathoms of water by day; nor by night, bring Madras light to bear anything south of S.S.W. $\frac{1}{2}$ W., until Pulicat light

* Information from the port officer at Madras, June 9th, 1884.

bears west, when it may be steered for, and anchorage picked up with the light on that bearing in 7 fathoms, when a vessel will be distant about $2\frac{3}{4}$ miles from the shore.

NELLORE DISTRICT has 16 ports, or open roadsteads, where cargo is shipped, and the custom house authorities have so arranged that the north limit of the one forms the south limit of the next. None of these ports are of much importance. They consist as follows, commencing from the south: Púdi, Armeghon, Túpili, Pamanji, Kistnapatam, Maipaud, Pomapudi, Isakapalli, Juvaladirai, Tamalapenta, Conaypalem, Ramiapatam, Pakala; after which a break occurs, then Itamukla, Kottapatam and Kameparti which is connected with Kottapatam. The chief of these are Kottapatam and Kistnapatam.

POINT PÚDI, bears N. $\frac{3}{4}$ W. distant about 22 miles from Pulicat lighthouse; the coast between is low, with a few crab trees, forming a shallow bight, with soundings of 5 and 6 fathoms about a quarter of a mile from the beach. At point Púdi a sandy shoal having over it from one to $2\frac{1}{4}$ fathoms extends for $2\frac{1}{4}$ miles in a S.S.E. direction; the outer edge of this shoal having depths of 4 fathoms, is distant a mile from the coast. Point Púdi is formed of low sand hills, with a small but thick grove of trees, a little to the southward of it.

Anchorage off Púdi is in 5 fathoms, tenacious clay, sheltered by the Armeghon shoal, with Miniapolliem lighthouse bearing between W. by N. and W.N.W. opposite to a village called Royadorvu; the place is known locally as Púdi-Royadorvu, and is subordinated to Armeghon.

ARMEGHON, the first spot on the east coast of Hindustán occupied by the British in 1625, and where a factory was established in 1628, is now a small village the resort of salt makers. It is situated near the north end of the Pulicat lake, about a mile from the coast, and bears N.N.W. $\frac{1}{2}$ W. distant $13\frac{1}{2}$ miles from point Púdi, the coast between trending in about the same direction.

LIGHT.—Close to the coast near the village of Miniapolliem, distant $6\frac{3}{4}$ miles S.S.E. $\frac{1}{2}$ E. from Armeghon, is a white stone column 111 feet in height, from which, at an elevation of 107 feet above the sea, is exhibited a *white revolving* light, attaining its greatest brilliancy every twenty seconds, and visible in clear weather from a distance of 14 miles.

Armeghon shoal extends from near point Púdi for about 10 miles in a northerly direction, with depths over it from $1\frac{3}{4}$ to 3 fathoms; the south extreme of the shoal bears from point Púdi N. by E., distant 2 miles. The outside edge of Armeghon shoal is 7 miles distant from the coast, and the depths rapidly increase as the land is receded from, until at a distance of about 12 miles 42 fathoms will be found. At the shoalest part

($1\frac{3}{4}$ fathoms), which sometimes breaks, Miniapolliem lighthouse bears W. $\frac{3}{4}$ S., and here the shoal is about 2 miles in breadth.

DIRECTIONS.—There are no good landmarks hereabouts. Armeghon hill in lat. $14^{\circ} 1' N.$ about 8 miles inland, is a low table land with a pagoda near its centre, and seldom visible from the outer part of Armeghon shoal. In approaching this vicinity, vessels must not rely on sighting the land, which is often obscured by haze, but sound frequently, and avoid approaching the coast nearer than a depth of 20 fathoms.

The current, though generally governed by the wind is at times irregular, constant celestial observations, as well as sounding, are therefore recommended when in the neighbourhood of Armeghon shoal.

BLACKWOOD HARBOUR, sometimes called Armeghon roads, lies between the inner edge of Armeghon shoal and the coast, and has depths of from 4 to 6 fathoms good holding ground, over a space about 3 miles in width, east and west, by 10 miles in length.

To enter.—Strangers should keep in 12 fathoms until Miniapolliem light bears S.W. by S., or Armeghon hill W. $\frac{1}{4}$ S., and then steer direct for Armeghon hill, passing northward of Armeghon shoal in about 6 fathoms. A convenient anchorage during the south-west monsoon, is with Miniapolliem lighthouse, bearing W. $\frac{1}{2}$ N., distant about $2\frac{3}{4}$ miles, or as has already been described under the heading of point Púdi.

MIDDI river, with a village of that name near its mouth, enters the sea in lat. $14^{\circ} 15' 30'' N.$, or at about a distance of 15 miles to the northward of Armeghon river. About midway between is the entrance to the Suvarnamukhi river, which, with its tributaries, drains a large tract of country; but neither the Middi nor the Suvarnamukhi can be entered by any but small vessels. Kistnapatam on the north bank of the Middi river is the shipping port of Nellore, with which town it is connected by road. The trade is chiefly in salt.

Vessels occasionally anchor outside the mouth of the Middi river in 5 or 6 fathoms, about 2 miles from the beach, but this anchorage is only safe during fine weather. The entrance of the river, which leads to extensive backwaters is always open, and is made use of by the dhonies or native trading craft; it is said to have a depth of 11 feet at high water spring tides.*

* Kistnapatam is at the mouth of Middi river, the bar of which is changeable according to season; it sometimes has 9 feet at high water, but generally 6 or 7 feet. The anchorage in 7 fathoms, about 4 miles eastward of the town, is very soft mud and good holding ground. There is no swell in a gale. The B.I.S.S. *Khandala*, Captain Wicks, anchored there in the cyclone of May 1877, and found the water quite smooth, though breakers were visible some miles off. Vessels should not anchor just outside the bar, as there the holding ground is bad. Dhonies and native craft take shelter inside during stormy weather of April and May.—(Commander A. D. Taylor, late I.N., 1884.)

THE COAST from the Middi river trends N.N.E. for 7 miles to Kautapilli, and then about north for 16 miles to the mouth of the Pennair river, and throughout is low and sandy. The Shallinger sand, having over it depths of from 1 to $2\frac{3}{4}$ fathoms, extends in a N.N.E. direction from the coast between the mouth of the Middi river and Kautapilli for a distance of about 10 miles. It has not been closely examined, and the eastern or seaward side of this sand being steep-to, should not be approached nearer than in a depth of 10 fathoms.

PENNAIR RIVER is one of the largest in southern India, but like others on the east coast, its outlet is so shallow that only native craft can enter. On the south bank of the Pennair river, about 13 miles from the coast, stands the town of Nellore on rising ground, near to which numerous Europeans reside. The mouth of the river which is situated in about lat. $14^{\circ} 37' N.$, is not easily discerned from seaward, as in the last reach, the river trends to the northward, in which direction it enters the sea behind a sandy point, which is only a few feet above water.

Anchorage off the Pennair river may be obtained in fine weather and off-shore winds, in from 5 to 7 fathoms, at a distance of from $1\frac{1}{2}$ to 2 miles from the coast; sand and mud.

The coast from the mouth of the Pennair river trends nearly N.N.W., and continues its low and sandy nature.

ISAKAPALLI, situated $8\frac{1}{2}$ miles N.N.W. of the mouth of the Pennair river, may be recognised from seaward by a ridge of moderately high land at the back or westward of it, visible about 20 miles. The coast between Isakapalli and the mouth of the Pennair river, continues its low and sandy nature.

Grain and other produce is exported from Isakapalli, and a bungalow is maintained by Government for the use of the masters of ships; granaries and go-downs are on the beach.

Anchorage* may be obtained off Isakapalli in 7 or 8 fathoms, sand and mud, about a mile from the beach, westward of a bungalow situated half a mile south of the village. Cargo is taken from ships by the fishermen of the neighbouring villages. Bread and other necessities, except a

* Commander E. A. Inglefield, R.N., H.M.S. *Ringdove*, 1848, remarks "that Isakapalli was only known by a flagstaff on the beach and two bungalows. A shoal spit extends about half a mile southward from the flagstaff, so that vessels should anchor well to the northward. This is a secure and snug anchorage during the south-west monsoon only. The ground is good for holding. A heavy surf runs on the beach. On approaching or leaving point Pennair should have a good berth. In June a strong current set out of the bay to the southward, and although there was a strong breeze the *Ringdove* generally tide-rode."

few sheep and small quantity of fish, have to be obtained from Nellore, distant 23 miles. Large steam and sailing vessels occasionally visit Isakapalli.

Ramiapatam.--The coast continues its N.N.W. trend, and is low and sandy from Isakapalli for 18 miles to the northward, at which distance, in lat. $15^{\circ} 3' 30''$ N. is Ramiapatam, where there is a small native trade, the principal article of export being gunny. This part of the coast is safe to approach as near as a depth of 7 to 8 fathoms.

KOTTAPATAM is the chief and northernmost port in the Nellore district, and situated 23 miles northward of Ramiapatam, the coast between continuing low and sandy. Singaroya pagoda on a hill of moderate elevation, about $3\frac{1}{2}$ miles inland from the coast, near the entrance of the Mun Air river, is the only landmark between Ramiapatam and Kottapatam. There are a few cargo and fishing boats here, which may be hired at fixed rates for discharging cargo; also catamarans.

Anchorage of a temporary nature may be obtained during fine weather with the godowns at Kottapatam bearing N. 70° W. in 5 fathoms, about $2\frac{1}{2}$ miles from the shore.*

MUTAPOLLI BANK, or Mutapilli, the least water on which, a small patch of $2\frac{3}{4}$ fathoms, bears from Kottapatam E. $\frac{1}{2}$ S., distant $8\frac{1}{4}$ miles, has irregular depths of $4\frac{1}{2}$ and 5 fathoms, with a hard bottom, and is generally marked by overfalls. From the shoalest patch just alluded to the low land of the coast is scarcely visible even in clear weather, and the Pillore hills, which bear nearly due West, are seldom seen, being 18 miles distant.

A shoal of $2\frac{1}{2}$ fathoms bears N. 77° E., distant about 4 miles from Kottapatam, and is apparently formed on an extension of the coast bank of soundings.

DIRECTIONS.--The northern part of Mutapolli bank bears S. 53° W. distant 33 miles from False Point Divi, and is safe to approach to a depth

* Kottapatam carries on an extensive trade by sea in grain, oil-seeds, &c. It has a population of 5,000, and is connected by a good road with the town of Ongole. The superintendent of customs is also subordinate magistrate. It is resorted to by the British Indian Company's steam vessels as well as sailing ships. Singaroya pagoda is plainly visible from the anchorage. Chimakurti peak, 2,098 feet high, stands 23 miles inland of this place, bearing N. 63° W. It is a conspicuous land mark, often visible in the afternoon, when neither Pillore hills nor Singaroya pagoda can be distinguished.

Making the port from northward, steer down for the pagoda, taking care not to come under 10 fathoms till one of the landmarks is sighted. Anchor in 4 fathoms (at low water) with Kottapatam godowns N. 70° W., Pillore hill nearly West, and Chimakurti peak, N.W. by W.—(*Commander A. D. Taylor, late I.N., 1884.*)

of 10 fathoms; the bottom on the bank is generally coarse sand with broken shells in some places mixed with small stones. More to the southward, in the vicinity of the shoalest spot ($2\frac{3}{4}$ fathoms), the bottom is soft mud, which is the best guide for vessels working along the outer edge of the bank. Mutapolli bank should not be approached nearer than in 14 or 15 fathoms by day, nor 24 fathoms by night, and the lead should be kept going, as the soundings decrease suddenly from 30 fathoms.*

The Kistna district is the next north to that of Nellore, with a coast-line of about 95 miles. The port limits of this district extend about half a mile on each side of the various landing places, and the ports are ten in number,—Mutapolli, Budduranipalem, Iperpalium, Nizámpatam, Gangadipalem, Kottapalem, Nagayalanka, Moratota, Penumudi, Masulipatam.

Mutapolli village, from which the bank just described takes its name, is situated in lat. $15^{\circ} 42' N.$, or about 17 miles N.N.E. of Kottapatam. There is a grove of detached palmyra trees near the landing place, and with the aid of a telescope a small pagoda may be distinguished. A small river here finds its way into the sea, skirting near its mouth, a low sand hill, to the southward of Mutapolli. The coast from here northward is generally known as the Golconda coast, although in the Kistna district.

Iperpalium, or Viperpallium, in lat. $15^{\circ} 46' 30'' N.$, and 25 miles N.N.E. $\frac{1}{2}$ E. of Kottapatam, is a minor port, from which a considerable quantity of oil seeds are exported. It might formerly be recognised by a small grove of brab trees near the beach, and a few buildings which constitute the town.

Anchorage.—The best off Iperpalium, is in 4 to 5 fathoms, sand and mud, with the centre of the town bearing W.N.W., distant three-quarters of a mile.

NIZÁMPATAM, in lat. $15^{\circ} 52' N.$, is $16\frac{1}{2}$ miles E. by N. $\frac{3}{4}$ N. of Iperpalium. The coast between, which is low, trends to the eastward towards False Point Divi, and is safe to approach to $4\frac{1}{2}$ and 5 fathoms by day. The entrance to the river may be known by a small sand hill on its western bank. To the eastward of this river is the grove of Petapilli, which extends along the head of the bay formed between Nizámpatam and False Point Divi. There is a large native trade here.

FALSE POINT DIVI, in lat. $15^{\circ} 45' N.$, bears from Nizámpatam river entrance S. 58° E., distant 12 miles, and is low, covered with small mangrove jungle, and has shoal ground fringing it and extending

* Vessels getting ahead of their reckoning, and overcasting their lead, are not uncommon occurrences on this coast, and should be carefully guarded against. When soundings are obtained on the edge of the bank in 45, 40, or 30 fathoms, preparation should be at once made, in sailing vessels, to stand off the land, as the distance may be not more than 6 miles from dangerous patches.

seaward from 3 to 4 miles, where the soundings are from $2\frac{1}{4}$ to 3 fathoms gradually increasing to 6 fathoms, about 6 miles off shore. This bank, extends the whole way to point Divi, to the northward.

THE KISTNA RIVER takes its rise about 40 miles from the Western Gháts at Mahábaleshwar in the Bombay Presidency, flows across the peninsula of Hindustán in an easterly direction, and after a course of about 800 miles, discharges itself into the bay of Bengal by several branches, one of which finds its outlet near False Point Divi. The district takes its name from the river, which is considered useless for navigation by sea-going vessels.

POINT DIVI in lat. $15^{\circ} 57' 40''$ N., forms the continuation of the coast northward of False Point Divi, is low, with a few trees, and has a narrow sand spit extending from it about 2 miles in a south-east direction. Another mouth of the Kistna river here finds exit into the sea.

Tides.—The rise of spring tides at point Divi is 5 to 6 feet; the whole neighbourhood is subject to inundation with on-shore gales. It is high water, full and change, at 8h. 15m.

LIGHT.—From a column coloured white, 50 feet high, situated about 2 miles north-west of point Divi, is exhibited a *fixed white* light, dioptric and of the 4th order, at an elevation of 48 feet above the sea, visible between the bearings from N. through west to S.W., and which should be seen in clear weather from a distance of about 14 miles.

Directions.—Vessels from Nizámpatam bound to the eastward should be guided entirely by the lead, and not approach the coast nearer than $5\frac{1}{2}$ or 6 fathoms by day. A vessel with a fair wind bound to the northward from False Point Divi, may stand along in a north-east direction, keeping in 7 or 8 fathoms, till abreast point Divi by day. By night, the coast should be approached with great caution, as the bank of soundings extends but a few miles to seaward. Even by day, the lead should be carefully hove when in soundings, as the coast is very low and frequently hid by haze.

MASULIPATAM, on a branch of the Kistna river, is the chief and northern port of the Kistna district, but of small commercial importance, the greater part of the trade finding its way to Cocanada. At Masulipatam there is a fort, but the garrison were withdrawn in 1865. The first British settlement on the Coromandel coast was established here in 1611, and a factory founded in 1622. The town is situated on a low unhealthy plain subject to inundations. In 1800, in May 1843, and in November 1864, Masulipatam was submerged during cyclones, the loss of life in each case being great.

LIGHT.—From Masulipatam fort flagstaff, at an elevation of 69 feet above the sea is exhibited a *fixed white* light, dioptric and of the 6th order, visible in clear weather at a distance of 6 miles.

Anchorage.—The best is in $3\frac{1}{2}$ fathoms, soft mud, with the flagstaff bearing about west. Small craft anchor nearer the shore in 3 fathoms. The roadstead is capacious, and has good holding ground; but during the north-east monsoon, with a ground swell, large ships would be compelled to anchor in 5 fathoms about 4 miles from the shore, communication with which will be found tedious and uncertain. The limits of the port are marked by boundary pillars. Ballast may not be thrown overboard in less than 10 fathoms of water.*

Directions.—Bound to Masulipatam from the southward, after making False Point Divi, stand in a north-east direction till abreast of point Divi, keeping in 7 or 8 fathoms, until Masulipatam flagstaff bears west, when steer for the anchorage under easy sail, keeping the lead going. In rounding Divi point do not come under 5 fathoms by day, nor 9 fathoms by night, till to the northward of it.

In June, July and August, vessels should endeavour to make point Divi by daylight, and hug the coast as close as prudence will permit, as the westerly winds frequently blow very strong during the south-west monsoon, necessitating beating into the anchorage, which will be found tedious owing to the freshes setting a vessel off the land.

During the north-east monsoon, vessels should invariably sight Narsapur point, and then steer for the anchorage.

The river mouth on which Masulipatam is situated, has a bar with a beacon, which denotes the position of the best channel across it for boats. Cargo boats proceed up the river for a distance of about 4 miles to discharge at the jetty in the port, or go on by canal to Bezvara on the main channel of the Kistna river.

Communication.—The steam vessels of the British India Company keep up bi-monthly communication with Madras, the northern ports, and Burma.

Trade and supplies.—Exports are castor, gingelly seeds, and cotton to Europe, and castor seeds and chillies to Calcutta. Imports are

* The limits of the port are between Tavisi-púdi on the north, and point Divi light-house on the south. The only mark for a vessel approaching from the eastward is Tavisi-púdi grove, which bears N.N.E. from the flagstaff, distant about 5 miles. It shows up like an island as the trees are high and compact. The grove shown on the charts about 11 miles north-east of Masulipatam has only about a dozen detached high trees. The best anchorage off Masulipatam in north-east winds, is with the flagstaff bearing W. by N. $\frac{1}{2}$ N.; but with southerly winds bring it to bear West, which is a more convenient position for boats coming out of the river.—(Commander A. D. Taylor, late I.N.)

generally rice, piece goods, and grain. In 1874-75, the number of ships which called was 235, the value of exports was 171,400*l.*, and of imports 119,600*l.*

There is a civil hospital and dispensary at Masulipatam.

Signals.—When communication with the shore is dangerous, owing to the surf on the bar, a red and white chequered flag is hoisted at the flag-staff of the fort. When the surf becomes impassable, a white pennant with a red ball is hoisted under that flag.

If a boat is urgently required during the night, three lights should be hoisted horizontally, and in case of fire or danger, blue lights should be burnt and guns fired.

THE COAST from Masulipatam trends N.E. for 12 miles, and then to the eastward to Narsapur point, forming Masulipatam bay, in which the soundings are regular, and the shores, low and sandy, are safe to approach to a depth of 5 fathoms, by day. The Samúlda, or Samúda river, discharges itself into the bay 25 miles eastward of Masulipatam.

GODÁVARI DISTRICT commences at Samúlda river, about 12 miles westward of Narsapur (Vasishta) mouth of Godáviri river; it has six British ports or roadsteads,—Perupalem, Narsapur, Bandarmalanka, Coringa, Cocanada and Uppada. Besides these, Yanaon, a small French settlement, stands $5\frac{1}{2}$ miles southward of Coringa, at the point where the Coringa river issues from the Godáviri.

NARSAPUR POINT is low, woody, and marked by an obelisk 80 feet high. It forms the western shore of the river of that name, and bears N.E. by E., distant 35 miles from point Divi, the coast between, as has been stated, forming Masulipatam bay. The Narsapur river or Vasishta Godáviri, which is a branch of the Godáviri, would be navigable for large vessels were it not for the bar, on which there is only 9 feet at high water. Outside, there are soundings of from 2 to 3 fathoms, at a distance of 2 miles southward of the entrance. The channel leading into the river, is between two sand banks, on which the sea breaks.

Ships rounding Narsapur point should not come into less than 6 fathoms by day, nor 12 fathoms by night. Formerly, vessels of from 300 to 400 tons were built on Narsapur river; native craft still resort to this place for repairs; but the boat-building business is languishing and the population on the decrease.

Narsapur town, population about 6,000, lies 6 miles up the river. Cargoes are mostly discharged at Antravedi near the river mouth. Madapalem, which gives its name to a certain cheap cloth fabric, once joined Narsapur, but erosion of the fore-shore of the river, has caused the present town of Narsapur to be built on the opposite bank. Narsapur has a celebrated

Hindu shrine, visited once a year during a five days festival by 20,000 pilgrims.

THE COAST from Narsapur point trends N. 68° E. for 13 miles to the mouth of the Bandarmalanka river* and is low, but thickly wooded. This part may be approached to 8 fathoms by day; the soundings to seaward, however, deepen suddenly to 50 and 100 fathoms about 9 miles off shore.

From the entrance of the Bandarmalanka river (which is a small port only visited by native craft), the coast takes the direction of N.E. by E. $\frac{1}{4}$ E. for 28 miles, to a position where there is a small grove of brab trees near the beach, which bear from Hope island lighthouse (to the northward) about S. $\frac{1}{4}$ W., distant $9\frac{1}{2}$ miles; this part of the coast is low and sandy, and in hazy weather is seldom visible farther off than at a distance of 4 or 5 miles.

Caution is necessary in approaching this neighbourhood on account of the Sacramento shoal, and vessels working up or down the coast should keep the lead constantly going, and not come into less than 14 fathoms.

SACRAMENTO SHOAL,† on which the *Madras* grounded in September 1865, and on which the U.S.S. *Sacramento* was lost in June 1867, is reported to lie abreast the Kothapalem river, or in about lat. $16^{\circ} 33' N.$, long. $82^{\circ} 15' E.$, and to consist of hard sand, extending 2 miles east of the entrance to the river; it is probably enlarged or reduced according to the freshes setting out of the river. The soundings decrease rapidly in approaching, and the sea breaks heavily upon it in bad weather.‡

A shoal has also been reported (1881) to exist in lat. $16^{\circ} 35' N.$, long. $82^{\circ} 19' E.$, or $4\frac{1}{2}$ miles N.E. by E. of the above position assigned to the Sacramento shoal.

HOPE ISLAND, in lat. $16^{\circ} 49' N.$, is low, swampy, covered with jungle, and only 3 feet above the sea; consequently it is submerged during high tides. Hope island is $1\frac{1}{2}$ miles in length north and south, by $3\frac{1}{4}$ miles in breadth, and forms one of a broken chain of similar islands, formed by the

* After freshets a shoal spit is said to form off the mouth of the Bandarmalanka river.

† The position of Sacramento shoal is still uncertain.

‡ At 10.30 a.m. June 24th, sighted the wreck of the *Sacramento* and anchored about half a mile from her, in $6\frac{3}{4}$ fathoms. "She had struck on a spit on which a heavy surf was breaking, and had been washed over into smooth water, about $1\frac{1}{4}$ miles from the beach. The spit is not on the chart, nor mentioned in any directory. The mouths of the Godáviri silt up these spits in a remarkably short time, therefore, a vessel proceeding along this dangerous coast should keep the lead constantly going and never draw into less than 10 fathoms water."—(Remark Book of Commander R. Bradshaw, H.M.S. *Star*, 1867.)

alluvial deposit brought down by the Godávári river, at the mouth of which it is situated.

LIGHT.—On the south part of Hope island, about $2\frac{1}{2}$ miles from the sea, is a column 94 feet in height, coloured in alternate horizontal bands, black and white, from which is exhibited at an elevation of 83 feet above the sea a *fixed white* light, visible in clear weather between the bearings of N. 20° E., through west to S. 20° W., from a distance of 15 miles.*

Godávári point, often termed Gordeware, extended, in 1882, 5 miles in a northerly direction from Hope island lighthouse. It is low, sandy, and covered with trees, and the sea breaks heavily on it during the south-west monsoon. An extensive mud flat projects from its northern extremity; and on its western side, is the entrance to the Godávári, also known to mariners as the Gordeware river.

A tripod beacon, surmounted by a pole with basket, 28 feet high, is placed upon the dry sandy point of Godávári, about 6 cables S.S.F. of the northern extremity of the point, and $4\frac{3}{10}$ miles N. 29° E. from Hope island lighthouse.

A red buoy, with pole and basket, is placed in $6\frac{1}{2}$ fathoms to the northward of the Godávári shoals, with Hope island lighthouse bearing S. by W. $\frac{3}{4}$ W., and Vakalapudi lighthouse N.W. by W., or $3\frac{3}{10}$ miles northward of the dry sandy extremity of Godávári point. The position of this buoy cannot always be depended upon.

DIRECTIONS.—Approaching Cocanada from the southward by night, a ship should not haul in for Vakalapudi light, till it bears W.N.W. By day, it is recommended to pass fully half a mile northward and eastward of the red buoy. The high hills northward of Cocanada may generally be seen, and if in coming from the southward this high land is found to bear westward of N.W., a vessel is then too far to the northward.

For description and directions for Cocanada and Coringa bay, see next chapter.

* Hope island lighthouse is often obscured by the mist rising from the low jungly ground. The locality swarms with insects, and myriads of these hover about the lantern, particularly during a calm night, and obscure the light. Great caution should therefore be exercised in approaching this coast during the night.

A new *fixed white* light, dioptric, of the fourth order, was exhibited from Hope island lighthouse in May 1886.

CHAPTER IV.

GOLCONDA AND ORISSA COASTS.—COCANADA TO FALSE POINT
AND DHAMRA RIVER.

VARIAION 2° 10' to 2° 40' E. in 1887.

COCANADA,* situated in the bight of Coringa bay, in latitude 16° 56' N., about 7 miles westward of Godávári (Gordeware) point, stands on the banks of a small river, which is connected with the Godávári river by a canal 32 miles in length, at a town called Dowlaishvaram, and is considered the principal seaport of the Godávári district, as well as the safest natural port on the east coast of Hindustán. Two small piers run out from the mouth of the Cocanada river, and the attempt is made to keep the entrance open by dredging, but it is silting up with the deposit brought down by the Godávári, through its numerous mouths which enter the sea in Coringa bay.

Aspect.—Northward of Cocanada, the high land at the back of Samulkota, forms several flat-topped ranges of considerable elevation. The most remarkable is a round mountain, 1,657 feet high, situated about N.N.W., 19 miles distant from Uppada house. Barn hill of the chart is seldom visible, being 15 miles distant from the anchorage.

Lights.—On the groynes in course of construction at the entrance of the Cocanada river, are exhibited, at an elevation of 10 feet above the sea, two *fixed red* lights, visible in clear weather from a distance of 2½ miles.†

Anchorage off Cocanada, with Vakalapudi lighthouse bearing N.N.W. ½ W., distant about 2¾ miles, is safe, with a soft bottom, but good holding ground. Large ships lie here at all seasons, and although the anchorage is about 3½ miles from the mouth of the Cocanada river, yet owing to the waters of the bay being generally smooth, and the navigation easy, communication with the shipping and the shore is never impeded. Although exposed to winds from N.N.E. to E.S.E., and in a gale offering

* See Plan of Cocanada or Coringa bay showing the mouth of the Godávári river scale, $m = 0.7$ inches, on Admiralty chart, No. 71a.

† These lights are intended to serve as a guide for boats entering or leaving the river

a lee shore, vessels never put to sea from here on the approach of bad weather, and in the event of a vessel being driven from her anchors, which seldom occurs, the soft muddy bottom proves security against any serious damage.

CORINGA BAY, or the bay of Cocanada, is an extensive mud flat, with sand in some places, and scattered along its southern part are sand banks, which uncover at low water spring tides. The bay has been silting up for many years, owing to the gradual advance of the shoals formed by the deposit brought down by the Godáviri river. The effect of this process has been to shift the anchorage further to the north-east, but without in any way diminishing its safety. Like Masulipatam, Coringa bay is liable to periodical inundations during hurricanes. In 1706, May 1787, and in 1839, Coringa, a town situated about $7\frac{1}{2}$ miles south of Cocanada, access to which from seaward except by small craft is now blocked by miles of mud flat, was completely inundated, the water rising above the roofs of the houses.

GODÁVARI RIVER, which rises about 70 miles north-east of Bombay, within 50 miles of the west coast of Hindustán, traverses the whole breadth of the peninsula in an easterly direction, and is said to be 900 miles in length, with a breadth in parts during the rainy season of $1\frac{1}{2}$ miles, discharges itself by its northern and principal mouth about 7 miles south-east of Cocanada.

The main channel into the Godáviri river, which in 1882, was not more than a cable wide, had its entrance at a distance of $1\frac{1}{10}$ miles S.W. of the red buoy moored about $3\frac{1}{4}$ miles northward of point Godáviri (Gordeware), and had a depth of 7 or 8 feet at low water on the bar, deepening to 13 and 14 feet inside, and to 20 and 30 feet in the narrow channel between Grass point and Hope island. There are heavy breakers on the bar at almost all times. Lanes are cut through the jungle from the west shore of the channel near Hope island towards the town of Coringa to the westward. The entrance to the Coringa river, which is very shallow, is about 2 miles south-east of the entrance of the Cocanada river, and a road connects the town of Coringa with that of Cocanada.

CORINGA is now considered a closed port, the channel through the flats leading to the river having only from one to 4 feet at low water. Small vessels are built at Coringa—spars can be purchased, and carpenters obtained. At about 6 miles above Coringa is the French settlement of Yanaon or Yanam.

LIGHT.—At Vakalapudi, $2\frac{1}{2}$ cables from the shore on the west side of Coringa bay, and about $4\frac{6}{10}$ miles N. by E. $\frac{7}{8}$ E. of the former lighthouse at Cocanada, is a white column 76 feet high, from which, at an elevation

of 80 feet above high water, is exhibited a *flashing* white light, showing a flash every twenty seconds. This light is intended to lead clear of the shoal ground extending northward of Godávári (Gordeware) point.

DIRECTIONS.—Sailing vessels bound to Cocanada in the south-west monsoon should fall in with the land near Bandarmalanka, in about latitude $16^{\circ} 30'$ N., where is a grove of trees,* and coast along to the northward, by day in about 10 fathoms. Great care is necessary between Bandarmalanka and point Godávári, on account of Sacramento shoal, about 15 miles to the southward of Hope island lighthouse described at page 125. The beacon near point Godávári, 28 feet in height, may be recognised, but that point should not be approached nearer than in 10 fathoms, until Vakalapudi light bears westward of W.N.W., when the anchorage may be steered for, and a berth taken up in about 5 fathoms. A red buoy with pole and basket, when in position, is placed $3\frac{3}{4}$ miles N. 15° E. of the beacon on Godávári point, in $6\frac{1}{2}$ fathoms, and a vessel should keep outside and about three-quarters of a mile distant from the buoy, when rounding the shoal ground extending northward from Godávári point, before steering for the anchorage.

When working into the anchorage in the south-west monsoon vessels should not stand further to the south-west than 6 fathoms at low water. The lead should be kept constantly going, as the water shoals very rapidly when standing into Coringa bay, and the lead will be found the best guide.

During the north-east monsoon, or from October to the middle of February, vessels should make the land off Pentakota, about 30 miles northward of Cocanada, and then steer along the coast to the southward in 12 fathoms. In the absence of observations, and doubt existing as to whether a vessel is to the north or south of Cocanada, it will be found that if a vessel be to the northward, the land will appear bold, with the range of hills extending away to the north-east as far as the eye can see; if to the southward, the coast will be low and sandy, interspersed with a few sandy hillocks, palmyra trees or low jungle.

At night, approaching from the southward great care is necessary, the lead should be kept going, and a vessel should not close the shore nearer than in 12 fathoms. It would be prudent to anchor in about 10 fathoms until daylight, and then run in and select a convenient berth.

From the northward, during the north-east monsoon, the anchorage should be approached with Vakalapudi light bearing W.S.W., and when in 8 fathoms, anchor.

Current.—From September to January or February the current runs with great force to the south-west, and vessels should endeavour to fall in with the land to windward of the port; if once set to leeward it will be

* Black grove of the chart.

tedious, during the strength of the north-east monsoon, to work up the coast, and often necessitate putting to sea again.

Tides.—It is high water, full and change at Cocanada at 9h. 15m., springs rise $4\frac{1}{2}$ feet and neaps $3\frac{1}{2}$ feet. The stream of the ebb tide sets to the north-east, flood to the south-west. The spring flood tides are strong in this locality, especially from October to February, and must be taken into account when closing the land near point Godáviri and Cocanada. The tides are irregular, and greatly influenced by the wind, and the freshets out of the Godáviri river.

The tides are subject, also, to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by at times as much as one foot.

Trade of Cocanada has increased since the introduction of works of irrigation in the district, which have tended to cheapen the productions of the country. Exports to Europe consist of cotton, rice, gingelly seed, jaggery, &c. There is also a large trade with other ports of the Indian seas. In 1874-75 exports were valued at 826,100*l.*; imports at 189,200*l.*

Supplies can be obtained from Calcutta by means of the British India Company's steam vessels which call weekly, and there is also communication with Rangoon. Consular agencies for the chief countries of Europe exist; and there is a hospital for seamen. Lascar crews can be obtained at Cocanada.

Signals.—The master attendant's flagstaff at Cocanada, is visible from the anchorage, but owing to the great distance off-shore at which ships anchor, signals cannot readily be distinguished, especially in hazy weather. The limits of the port are defined by boundary pillars, and extend seaward to 13 fathoms of water. No ballast is permitted to be thrown overboard in a less depth than 12 fathoms.

The COAST from Cocanada trends N.E. $\frac{1}{2}$ N. and is low for about 15 miles with numerous villages and cocoanut trees, low sand hills then commence, and continue to Pentakota, a further distance of 16 miles. At $5\frac{1}{2}$ miles distance from Vakalapudi light, is Uppada, a minor port for native craft only.

PENTAKOTA* distant 31 miles northward from Cocanada is a small port of rising importance, situated in the south part of Vizagapatam

* Captain E. J. Blake, of the ship *Panic*, remarks :—At Pentakota “the houses lie to the south-west of the hills. The southernmost is the custom house; it is a long low house with white ends, brown roof with white vertical stripes. The anchorage is with the village bearing about West in the north-east monsoon. In the south-west monsoon it would be better to have the village bearing about N.N.W. as the masula boats pull to windward better when loaded than when light. A north-east wind sends a heavy sea along the coast, and the place is difficult to distinguish in approaching from the southward when you are a few miles from the land. In November, the current sets to the north-east at the rate of $2\frac{1}{2}$ miles an hour, at its strength, which was from 6 a.m. to 4 p.m. During the night it used to ease, but never set to the southward.”

district, at the mouth of a river in lat. $17^{\circ} 19' N.$ The entrance to the river may be known by two sand hills of moderate height, and a cocoanut grove close to them. Bearing $N. 77^{\circ} W.$ from the mouth of Pentakota river, distant 8 miles, is Tuni hill, of conical shape, and a good landmark for making the place. Pentakota has a custom house and flag-staff, and there is a considerable export trade consisting of myrabolams, hides, skins, horns, gingelly seed, rice and gram, valued in 1875 at 22,500*l.*

A heavy sea rolls in here during the south-west monsoon, at which season the bar of the river is closed, and shipping operations are attended with great delay and risk. But during the north-east monsoon, the river being open, shipments are carried on more speedily.

Anchorage in the south-west monsoon is best in 7 fathoms about a mile off shore with the flagstaff bearing about N.W. by N. $\frac{1}{2} N.$

In the north-east monsoon anchor with flagstaff W. by N., and Sanjib peak N. by E.

Wreck-buoy.—In 1881, a green buoy was placed to mark the position of the sunken vessel *Mariana*, in $6\frac{3}{4}$ fathoms at low water, with Pentakota flagstaff bearing W. $\frac{1}{2} N.$, distant about $1\frac{1}{2}$ miles.

Coast Aspect.—The feature of the sea-board, between Pentakota and Vizagapatam, is a succession of rounded hills, conspicuous at night, showing up well in contrast with the low sandy plain on which they stand.

Wattara,* or Ratada, in lat. $17^{\circ} 26' N.$ or 17 miles N. $60^{\circ} E.$ of Pentakota, is situated on a table land at the south point of entrance to a small bight, formed at the mouth of three small rivers. It was formerly a minor port. Quoin rock about 4 miles westward of Wattara is steep on its sea face, and resembles a gunner's quoin.

Sanjib peak, in lat. $17^{\circ} 32' N.$ and about $12\frac{1}{2}$ miles to the north-west of Wattara, is conical, and highest of the range visible from seaward, attaining an elevation of 2,145 feet.

PUDIMADAKA, or Pudi, situated 9 miles to the north-east of Wattara, is a small village, the whereabouts of which may be recognised by a remarkable rocky islet, Pillar rock, bearing S.E. by S. of the village, and distant three-quarters of a mile from the shore. Pillar rock has near it about 5 fathoms, and between it and the shore extends a ledge of rocks, which serve as a breakwater during the south-west monsoon, so that vessels at that season are enabled to load with facility, and carry

* The coast of Orissa, or Orixia, is said to commence to the south of Wattara, extending from thence to the entrance of the river Húgli, but the south part of this coast has been generally called the Northern Circars, and the name Orissa applied to that part north of Kalingapatam.

on communication with the shore. A small export trade is carried on from Pudimadaka.

Anchorage may be obtained in 6 fathoms with Pillar rock bearing about S.W. by S., and the "godowns" on the beach W. by N., during the south-west monsoon; but, during that from north-east, vessels should anchor further from the shore, in 7 or 8 fathoms, so as to give Pillar rock a wide berth in case of being compelled to put to sea.

The COAST from Pudimadaka trends about N.E. by E. and bulges outward in a slight curve for about 21 miles to Vizagapatam; it is bold, and, with favourable weather, may be approached as near as 2 miles without danger, the depths at that distance varying from 12 to 18 fathoms, the water deepening as Vizagapatam is approached.

Double Quoin rock, about 4 miles north-eastward of Pillar rock answers to its name. Viewed from the northward, it appears a low black double rock on the sandy beach. The coast immediately north and south of it is sandy, with a few scattered rocks along the beach.

Bluff Hummock, about 80 feet high, is an isolated black rock 10 miles south-west of Dolphin's Nose of Vizagapatam. The adjoining beach is high and sandy, the sand being much blown up the south face of the hills Southward of Bluff hummock are numerous small round hills.

VIZAGAPATAM* may be recognised from seaward by Yarada hill, 1,174 feet high, which slopes gradually towards the coast and terminates abruptly in the sea to the northward, in Dolphin's Nose, a bluff headland, with a masonry tower and flagstaff on its summit, and several houses on its north side, and on which, formerly, a light was exhibited.†

Adjoining Vizagapatam, about $2\frac{1}{2}$ miles to the northward, is Waltair, formerly a military station, and still the head quarters of the district, where most of the Europeans reside. This place has been mistaken, by vessels strange to the coast, for the town of Vizagapatam, and occasionally anchored off in consequence.

The town of Vizagapatam, the chief of the district of the same name, is advantageously situated as the outlet for the products of the Eastern and Central Provinces of India, on a level amphitheatre, formed by two parallel ranges of hills. Of late years it has increased considerably, and contains 32,000 inhabitants, many of whom are Muhammadans.

Anchorage, the best is in from 5 to 7 fathoms, sand, with the fort flagstaff bearing W. by N. $\frac{3}{4}$ N., the mosque on a hill near the river entrance W. $\frac{1}{4}$ N., and the flagstaff on Dolphin's Nose S.W. $\frac{1}{4}$ S. In

* See Admiralty plan of Vizagapatam, No. 239, scale, $m = 1.95$ inches.

† Lantern destroyed by cyclone of November 1876, and not since renewed.

this position the river will appear open, and the eastern extremity of Dolphin's Nose will have shut in the land to the southward of it. Care should be taken in anchoring, as the soundings shoal quickly, and a large vessel anchoring in 6 fathoms, swinging towards the shore, may find her stern in $4\frac{1}{2}$ fathoms at low water. The bottom inside the 3-fathom line northward of the town is foul, and vessels should therefore not venture too close in.

Directions.—Dolphin's Nose, though a remarkable headland when approached from the north, or south, or coastwise, is obscured by the high land beyond it, when viewed from a distance seaward. In making the place during the north-east monsoon, endeavour to sight a conspicuous hill known as the Sugarloaf, situated midway between Vizagapatam and Bimlipatam, and about 5 miles north-east of Waltair. Coming from the southward, Pigeon island about 7 miles to the south-west of Vizagapatam and close to the shore, will be sighted, inside the bight formed between Dolphin's Nose and the first high land to the southward of it.

MAONDERU RIVER* drains the high land on which Vizagapatam is situated and discharges itself into the small bight immediately north of Dolphin's Nose. The river is said to be silting up, and is not accessible to vessels larger than the native brigs of about 200 tons common to the place. Mud docks for native craft are situated about a mile up the river. The limits of the port are defined by boundary pillars. There is a dispensary where Lascars can be treated. The bar, which has 6 feet over it at low-water spring tides, is dangerous, and can only be crossed in ships' boats in fine weather and during southerly winds.

Trade is increasing, and in 1882–83 the imports were valued at Rs. 829,127; exports at Rs. 2,405,822. The chief products are indigo, gingelly seeds, jaggery, and myrabolams. The steam vessels of the British India Company call weekly.

Tides.—It is high water, full and change, at Vizagapatam, at 9h. 3m., springs rise 5 feet, and neaps 3 feet; neaps range 1 foot. In common with other places on this coast the tides are subject to diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by at times, one foot.

Winds.—From March to June, the prevailing winds are south-west; in July and August north-west; in September westerly, and from October to December north-east. In the latter months, the north-east winds are

* Port improvements are contemplated at Vizagapatam, it having been under consideration to build an iron pier or breakwater out seaward from a position immediately southward of the present flagstaff. A railway to Jaipur has been recommended, the line for which has been partially surveyed.

fresh during the day, with light westerly wind at night. Heavy squalls with rain may be expected in October and November.

Waltair Point is a low sandy point about $2\frac{1}{2}$ miles north-east of Vizagapatam, with a rocky foreshore and red sandhills which are at times conspicuous from the offing. The bottom here, out to a depth of 8 fathoms, is foul, and vessels should not anchor near it. On the point is a house in ruins, with a grove of palm trees behind it. The north boundary of the port of Vizagapatam extends to close southward of the ruin.

The COAST from Waltair point trends about N.E. by N. for 13 miles to Bimlipatam, situated on the south point of entrance to a small river. About midway between Waltair point and Bimlipatam and near the coast is Sugarloaf hill, forming a conspicuous landmark. Between Vizagapatam and Bimlipatam the high land within a league of the sea forms three round mounds, nearly 1,000 feet high; this high land terminates about 5 miles south of Bimlipatam, the intervening gap having isolated conical hills.

Caution.—A reef of rock projects half a mile from the shore about $2\frac{1}{2}$ miles north-east of Sugarloaf hill. When passing along the coast from south to north, Santapilli peak should be kept in sight clear of the False head of Bimli.

BIMLIPATAM in lat. $17^{\circ} 53\frac{1}{2}'$ N. is distant about 15 miles from Vizagapatam in the direction of N.E. $\frac{3}{4}$ N. By day it may be recognised by a detached round hill, about 600 feet high, close to the beach, having a ruined pagoda on the south-east face of it, rather more than half way up, and a few scattered trees and ruined house on the summit. The town stands on a slope between this hill and the beach, and appears picturesque from seaward. The chimney of a disused sugar refinery is also visible from the offing. Approaching from the northward, Amnam, a red hill, 838 feet high, about 3 miles northward of the town, and 2 miles inland, having a level summit, is a good mark. In approaching from the eastward care must be taken not to mistake Amnam hill for that over Bimlipatam. Vessels from the southward and close inshore may not sight Bimlipatam until within 6 or 7 miles of the port, as a headland known as Upada bluff, near the Sugarloaf hill between Vizagapatam and Bimlipatam, intervenes.

The river leading from the backwater at Bimlipatam has a shallow bar, which can only be crossed by masula boats at half tide. The limits of the port are defined by boundary pillars.

Anchorage.—The bottom off Bimlipatam of sand and mud, affords good holding ground, and the roadstead is smoother than at adjacent ports along the coast, and safe to approach from seaward. In the south-west monsoon the best position is with the flagstaff bearing W. $\frac{1}{2}$ N., in 7 to 8 fathoms, about $1\frac{1}{2}$ miles from the shore. In the north-east

monsoon the flagstaff should be brought to bear about W. by S. $\frac{1}{2}$ S. Santapilli peak and its west hill should be seen open south or seaward of Amnam hill, when at anchor off Bimlipatam.

Tides are scarcely perceptible in the roadstead, but the rise and fall in the river is 3 feet 9 inches at springs, when the stream of the tide is strong.

Trade.—There is no direct import trade between Bimlipatam and Europe; wines, spirits, and piece goods being obtained from Calcutta and Madras. Gingelly seed is exported in large quantities to France, and rape seed, niger, jaggery, myrabolams, indigo, jute, hides, skins, and horns to England. In 1875–76 exports were valued at 246,132*l.*, and imports at 138,559*l.*

Supplies of fresh meat and live stock can be obtained, and native vegetables in season. There is a hospital where Europeans are admitted.

The steam vessels of the British India Company call weekly at Bimlipatam.

The COAST from Bimlipatam trends north-east, and is low and sandy for about 8 miles to Konáda point, where it projects slightly, and has a few brab trees growing on it. About midway between are some red cliffs, conspicuous from the offing. Northward of Konáda point, distant nearly 2 miles, is the mouth of Konáda river, having on its south bank the village of that name, and a small pagoda with numerous palm trees, and a high sand hill southward of them. Anchorage off Konáda, considered the north port of the Vizagapatam district, may be had in 5 fathoms with Konáda point bearing S.W. $\frac{1}{4}$ S., and the body of the palm trees in line with Vizianagram hills. On a hill, about three-quarters of a mile from the coast and 5 miles N.E. by N. of Konáda, is Santapilli lighthouse, $1\frac{3}{4}$ miles E. by N. $\frac{1}{2}$ N. of which, the Mentada river enters the sea.* Santapilli peak, a conical mountain 1,766 feet high, is an excellent landmark. Southward of it, and about 4 miles inland from the coast, is another hill about 600 feet in height, and north-eastward of this are two isolated hills, southward of Konáda hill on which the lighthouse stands.

SANTAPILLI ROCKS, distant $5\frac{1}{2}$ miles from the shore, and nearly due east from Konáda river, are dangerous and should be carefully avoided. During fine weather when the sea is smooth, the water does not break on the rocks nor does it present a discoloured appearance. The least water over them is 8 feet, but nearly in the centre, a portion of the steam

* The survey by Commander Fell (late I.N.), 1848, ended at the mouth of the Mentada river. From this northward to False point, no general description of the coast has been furnished, to supersede that of "Horsburgh."

vessel *Dacca*, wrecked in 1877, is awash at half tide, on which, even in calm weather, the sea breaks heavily. The reef, which is small in extent, is steep-to, having 12 fathoms near its eastern edge, and 10 fathoms near the western. The channel between the rocks and the main land carries from 6 to 9 fathoms and is $4\frac{1}{2}$ miles wide.

Clearing marks.—Santapilli peak, the remarkable hill previously described, 1,766 feet high, about 6 miles from the coast, in line with Santapilli lighthouse, leads clear to southward of the rocks. Vessels from the southward with this mark on may stand into 7 fathoms, when they can haul to the northward with safety inshore the reef. The lighthouse in line with the third hill southward of Santapilli peak will lead clear to northward of the reef.*

SANTAPILLI LIGHT.—From a low building 32 feet high, on a hill three-quarters of a mile inland, north-west of Santapilli rocks, or in about lat. $18^{\circ} 5' N.$ long. $83^{\circ} 37' 30'' E.$ is displayed a *fixed white* light, dioptric, of the second order, at an elevation of 173 feet above high water, visible in clear weather from a distance of 14 miles. From the shoalest part of Santipilli rocks, the light bears N. $52^{\circ} 30' W.$, distant $6\frac{1}{2}$ sea miles.

LANGULIYA RIVER† forming the boundary between the districts of Vizagapatam and Ganjám, discharges into the sea about 19 miles N.E. by E. $\frac{1}{2}$ E. of Santapilli lighthouse, and though a broad, is a shallow stream, filled with boulders of granite, and navigable only by native vessels of light draught. Breakers extend for about a mile seaward of the entrance to the river. Upon the east bank of the Languliya, river, distant 5 miles from the sea, is the town of Chicacole, the chief civil station in the Ganjám district. It is situated on low ground and after rain, its streets are said to be hardly passable, Chicacole is a military station.

KALINGAPATAM (Calingapatam)‡ the southern port of the Ganjám district, situated on the south bank of the Vamsadhára river, about 16 miles north-eastward of the mouth of the Languliya river, is a small town composed of five villages, the trading community of which is almost entirely native. The country in the vicinity is low and flat, and between Santapilli lighthouse and Kalingapatam consists of sandhills and a few scattered trees. The locality may be known by Gara hill, which is isolated and appears saddle-shaped from the southward, but conical from the eastward, and bears N. $81^{\circ} W.$, distant about $5\frac{3}{4}$ miles from Kalingapatam lighthouse. On the slope of the hill are two white

* See Admiralty charts:—Coromandel coast, No. 71a, Bay of Bengal No. 70.

† See Admiralty chart, No. 829, Cocanada to Bassein river.

‡ See Admiralty plan of Kalingapatam, No. 239; scale, $m = 1.95$ inches.

temples and a tree. At about 4 miles N.E. by N. of Gara hill, a low jagged rocky ridge of hills commences. The lighthouse forms the southern boundary mark of the port; that to the north being indicated by a pillar at the south end of Ampalam village.

LIGHT.*—On Sandy point of Kalingapatam from a white obelisk, 70 feet high, which has a blue band, is exhibited, at an elevation of 76 feet above high water, a *fixed white* light, visible in clear weather from a distance of 8 miles.

Satara reef of rocks, having 21 feet over the shoalest or northern part, is situated with Kalingapatam flagstaff, bearing N. 42° W., the lighthouse S. 51° W., at about 6 cables from the shore. The reef is steep-to on its north and east sides, having a depth of 7 fathoms, mud, within half a cable.

Anchorage.—During the south-west monsoon vessels should anchor in $6\frac{1}{2}$ to 7 fathoms with the port flagstaff bearing N.W., Gara hill W. $\frac{1}{4}$ N., and the lighthouse S.W. $\frac{1}{4}$ S. In the north-east monsoon the best position for shipping operations may be found with the port flagstaff bearing N.W. by W., Gara hill W. $\frac{1}{2}$ S., and the lighthouse S.W. $\frac{1}{2}$ S., in $6\frac{1}{2}$ to 7 fathoms.

In fine weather, an anchorage with the custom house shed on the beach bearing West distant about 7 cables, and the lighthouse S.S.W., in 5 fathoms, sand, may be adopted.

Vamsadhára River, on which Kalingapatam is situated, is closed to all traffic, native craft having abandoned it, owing to the entrance being blocked with sand banks.

Trade.—Exports consist of rice, gingelly, rape and niger seeds, myrabolams, jaggery, raw hides, buffalo horns, cereals, and curry condiments; but of late years the custom returns show a falling off. Steam vessels of the British India Company call once a fortnight.

Supplies.—Fresh provisions can be obtained, but have to be brought from Chicacole, $17\frac{1}{2}$ miles distant, two days' notice being necessary. Fresh water found here cannot be recommended.

WINDS AND WEATHER.—Between Kalingapatam and False point, about 200 miles to the north-east, the months of January and February are fine, with a smooth sea, the winds varying from north-west in the night to north-east and east in the day. After the middle of February, the weather

* The light is visible over an arc of 180° facing S.E., and is intended to warn ships making the port of Kalingapatam by night, off a small reef, which projects off Kalingapatam point, and which should not be passed in less than 8 fathoms. Haze hangs over Kalingapatam point during southerly winds (April and May) and the low land is often obscured, while the tops of Gara and other hills are visible. The noise of the surf on calm days may be heard 3 miles off.

becomes calm until the beginning of March, when the alongshore or southerly winds set in, and the current begins to run to the northward. During March and April the wind lulls at night, but after 10 a.m. blows fresh again, interfering with the shipment of cargo after that hour. During April and May occasional north-westerners blow with violence for a short time, but they are seldom accompanied with much rain. By the end of May the winds tend to the westward, and the swell on the beach commencing to run, causes a tremendous surf, which in June, July, and part of August, frequently stops communication from the open roadsteads for weeks. From June to September the winds are principally from south-west with occasional rain, but with a north-wester, at this period, the rain is very heavy. Late in September, the winds become variable, but the swell continues until October, in which month the north-east monsoon sets in generally with hard squalls and heavy rain. After October the north-east monsoon becomes fine, and the sea continues smooth until the end of February. At the end of November the wind at night draws to the north-west, giving ships bound up the coast from the southward a good opportunity of making a good passage.*

BÁVANPÁDU is situated in latitude $18^{\circ} 34' N.$, about 18 miles north-east of Kalingapatam and 4 miles from Naupáda, the coast between being low, and consisting of sand drifts. A column, coloured black and white, 50 feet high, built on the beach about 6 feet from high-water mark, marks the locality of the port, which but few seagoing vessels frequent. The export trade in 1875, amounted to 9,241*l.*; imports to 3,343*l.* A small rocky point bears S. by E. from the column. The best anchorage is with the beacon bearing W. by N. $\frac{1}{4} N.$, in from 7 to 9 fathoms.

PUNDI.—From Bávanpádu the coast trends N.E. $\frac{3}{4} N.$ for nine miles, and is of moderate height and uneven to the river Pundi, off which, rocks awash extend nearly a mile to seaward. The town is situated on the south side of the river; the coast for a mile on either side consisting of high sand hills, may be distinguished by a white obelisk, 50 feet high, built on a small hill which is about 17 feet above high water. East of the obelisk, in close proximity, is a travellers' bungalow, and the port flagstaff stands on the same hill. Some rocks above water lie about one mile S. by E. from the obelisk. Pundi has a considerable coasting trade and exports rice, myrabolams, and gingelly seed. The large cargo boats, as well as native craft, enter and discharge up the river, which has from 9 to 10 feet on the bar at high water springs. Supplies of fresh provisions for

* Captain E. J. Blake, in the ship *Panic*, states that in sailing from Coconada to Kalingapatam in October 1869, he found the current setting to the southward at the rate of 50 miles a day; but when about 60 miles distant from the land, there was very little current.—(Captain H. Toynbee, of the Meteorological Office.)

shipping, in small quantities, can be obtained. Inland of the town, and about 10 miles distant therefrom, is the high uneven country, known as the High Land of Pundi.

Anchorage.—The best, in the north-east monsoon is with Pundi flagstaff bearing about W. by S., in 7 to 9 fathoms, about 2 miles from the shore; in the south-west monsoon, with the same flagstaff bearing about W. by N. in from 9 to 10 fathoms.

BARUVA or Bárwa,* is situated about 16 miles N.E. by N. of Púndi, on the north bank of a river of the same name, near to which are several hills, nearly 500 feet high, without marked feature.† To the south-west of Baruva, are several clumps or topes of cocoanut trees, but to the north, is a barren plain covered with sand drifts, and a small hill about 70 feet high. The port, which is small, is marked by two columns, one black the other white, 50 feet high, built on a site about 13 feet above high water. The sea custom house has a flagstaff painted white. The black column is difficult to distinguish. The principal exports, valued in 1876 at 8,677*l.*, are rice, copra, cocoanuts, coir rope, salt fish, cashew nuts, grain and curry condiments. Good fresh water is procurable, and sheep, fowls, country vegetables, and fruit, are obtainable in the village.

Anchorage.—The best position is with the custom house flagstaff bearing N.W. $\frac{1}{2}$ W., and the northern of the two obelisks N.N.W. $\frac{1}{2}$ W., in 8 fathoms, sand and mud.

Between Baruva and Sonapur the coast is sandy, and about midway between the two places is a level plateau about 300 feet high, about 3 miles from the coast.

SONAPUR, at the mouth of a river, a minor port of the Ganjám district, is situated 17 miles N.E. by N. of Baruva, and may be known by a white obelisk and a white column each 50 feet high, built nearly at the level of high water. A grove of cocoanut trees stands on the sandy shore, half a mile southward of the town. Adjacent to the obelisk and column are situated the custom house and flagstaff, the latter painted black in contradistinction to that of Baruva. Trade here of late years has diminished, the chief exports consisting of rice and grain of different sorts. Fresh water can be obtained from a well near the custom house, and provisions may be had in small quantities at the village.

Anchorage should be picked up in 8 to 9 fathoms, with Sonapur obelisks, seen open, bearing W. by N.

* Sunken rocks are said to lie off shore about 2 miles S.W. of Baruva.

† Baruva high land, westward of Baruva, is conspicuous; Mahendragiri, its highest peak, is 4,923 feet above the sea, and with Deodangar, a distant detached nipple, 4,535 feet high, and about 18 miles westward of Baruva high land, may sometimes be seen 60 or 70 miles off, or when about 40 miles from the coast.

GOPALPUR bears about N.E. $\frac{3}{4}$ N., distant 10 miles from Sonapur, and is the principal port in the Ganjám district. Ichapur sharp peak, 5 miles westward from Sonapur has a conspicuous bungalow on its summit. Gopalpur knuckles, about 14 miles westward of Gopalpur, consist of four peaks, of which the highest is 2,892 feet. Karapar, an oblong-shaped hill is about 7 miles northward of the port, and $4\frac{1}{2}$ miles inland. A little to the south-west of Karapar hill stands Mansurkota pagoda, upon woody and level land of moderate height. There is a large white building on the beach, to the southward of which building is the custom house. The town of Gopalpur is on the south side of the river, on ground about 100 feet high, which extends about a mile to the south-west. A succession of sand hills are formed below the town. The flagstaff at this port is white and fitted with a separate top-gallant mast, which assists to distinguish the place from similar roadsteads on this coast. The limits of the port are defined by boundary pillars. At the mouth of the small shallow river or Mansurkota is a fort.

Anchorage in 8 to 9 fathoms, sand and mud, distant about $1\frac{1}{2}$ miles from the shore, may be obtained with the port flagstaff bearing N.N.W. $\frac{1}{2}$ W., and the most southern of the large buildings on the beach N.W. $\frac{3}{4}$ N. Avoid anchoring with the flagstaff westward of N.W. as the ground there found is rocky.

LIGHT.—From the flagstaff on the main land, about 60 yards from low water mark, is exhibited at an elevation of 85 feet above high water, a *fixed white* light, visible in clear weather at a distance of 10 miles.

Trade.—Value of exports in 1876, 290,987*l.* and of imports 161,141*l.* Gopalpur is the chief outlet for the produce of the surrounding district and sends to Europe rice, grain, myrabolams, hemp, horns, sugar, rum, raw hides, gingelly and rape seeds. There is weekly communication by British India Steam Company's vessels with Calcutta and Madras, but telegrams must be sent by runners to Berhampur. An aggregate of 60,000 tons of shipping are said to annually visit this port.

Supplies of fresh provisions have to be brought from Berhampur, a military station, 8 miles inland, where there is a hospital which admits Europeans. Fresh water is obtained from a well on the beach.

GANJÁM at the mouth of the Rushikulya river, at the northern confine of the Madras Presidency, is about 15 miles distant from Gopalpur, the coast between trending about N.E. $\frac{1}{2}$ E. The town, formerly the capital of the district, with the remains of an old pentagon fort, stands on somewhat elevated land with a range of high mountains in the background, but to the northward, the country in the vicinity of the great Chilka salt lake, is low and often flooded. Ganjám Saddle hill stands about 7 miles north-west of the port, but, in the approach it disappears among other

hills. The collector's head-quarters are at Chatrapur, about 3 miles inland. The general trade of the port is inconsiderable. Provisions may be procured in small quantities, and fresh water is to be had at a charge of 3 rupees per boat load. The limits of the port are defined by boundary pillars. There is a port officer here.

Anchorage in good holding ground may be had with the port flagstaff bearing about West, in from 8 to 9 fathoms. It is prudent for sailing vessels to heave-to to windward of the port, and signal to ascertain the best anchorage from the port officer, it being necessary, in order to facilitate shipping operations, to anchor abreast the mouth of the small river, which is constantly shifting to the north or south, and cannot be distinguished from the offing. Vessels should not ride with less than 60 fathoms of cable during the north-east monsoon, nor with less than 90 fathoms in the south-west monsoon.

Directions.—In making Ganjám from the southward during the south-west monsoon, at night, ships should keep in from 20 to 30 fathoms, endeavouring to sight the light at Gopalpur, and wait for daylight to make the roadstead. The anchorage may then be distinguished by the port flagstaff with some white buildings near it, and a remarkable looking bluff the south-east extreme of the amphitheatre of lofty hills which skirt the Chilka lake, about 4 miles to the north-east of the flagstaff, known as Palur bluff. The long white wall of the cemetery, about one mile northward of the flagstaff, is conspicuous in the early morning.

THE COAST from Ganjám curves in about a N.E. $\frac{1}{2}$ E. direction, and is backed throughout by high sand hills for 36 miles, at which distance is the entrance of Chilka lake, a sheet of brackish water about 44 miles in length north-east and south-west, by 20 miles in breadth, with an average depth of from 3 to 5 feet, and which is separated from the sea by a narrow tongue of low sandy land. With strong easterly winds the sea sometimes washes over this low land in places, and the dimensions of the lake become enlarged. The entrance or inlet in lat. $19^{\circ} 42' N.$ is narrow and deep, and when the lake is full, the outward current is occasionally strong. After heavy rain in the interior, the out-rush of water is great, and the breakers extend 3 cables off shore.

Manikpatam is a village situated on the shore of Chilka lake, about 3 miles south-west of the entrance, in lat. $19^{\circ} 42' N.$, from whence the salt obtained from the lake is exported. It may be recognised by a small pagoda surrounded with buildings, having near them some trees. As a port, Manikpatam is not important, and frequented only by coasting craft.

RAMBHA, an important village at the southern extremity of Chilka lake, has an extensive native trade with Orissa, exchanging salt for

grain. A steam launch plies between Rambha and Burukudi on the Purí side, a distance of about 34 miles. Chilka canal connecting the southern end of the lake with the Rushikulya river, is 7 miles in length, and navigable throughout the year; grain and salt in considerable quantities are carried by means of it.

Near the south end of Chilka lake is the boundary between the Madras and Bengal Presidencies.

Caution is necessary in approaching the coast between Ganjám and the entrance to Chilka lake, not to get into a less depth than 12 fathoms. A bank having 4 fathoms water close to its edge is said to extend 2 miles seaward from this part of the coast. Under ordinary circumstances it will be prudent to keep in 20 fathoms. The nature of the bottom within a distance of 3 miles is sand, beyond that distance, mud.

PURÍ (POOREE), or Jagannáth, (Juggernaut) bears about N.E. by E. $\frac{3}{4}$ E., distant 14 miles from the entrance to Chilka lake, and is situated near the sea on a low sandy ridge. The pagodas for which it is famous stand at the south end of the town, at a short distance from the sea, on low land with small trees, and near them are many smaller white buildings. There are three large circular buildings of conical form, decreasing in diameter from base to summit, crowned with white domes. The western pagoda, with conical tower 192 feet high, is the largest, and the eastern the smallest of the three. When bearing W. by N. they appear nearly in one and when N.N.W. they show as distinct buildings, though from a distance they seem connected. The west side of the large Jagannáth pagoda is perpendicular, while its east side appears to slope. It is used as a landmark for making the coast by vessels, particularly in the south-west monsoon.



Jagannáth (Juggernaut) Pagoda.

The flagstaff at Purí is situated in about lat. $19^{\circ} 48' N.$, the crossyard upon it points east and west. No vessel may throw over ballast in less than 11 fathoms. The limits of the port are defined.* In January the land

* Purí port limits are,—To the south-west, a line extending S.S.E. from Swergadwar temple to a depth of 10 fathoms at low water. To the north-east, a line parallel to the above, distant one nautical mile, extending to 10 fathoms at low water, the shore end to be marked by a brick pillar. To the south-east, the 10 fathoms line at low water. To the north-west, the foreshore for 150 feet within high-water mark, extending from Swergadwar temple to the north-east pillar.

wind is moderate and northerly, a sea breeze setting in from the eastward in the afternoon.

LIGHT.—From a white pedestal 33 feet high, situated on the parapet wall of the circuit house, or 270 yards N.E. $\frac{1}{2}$ E. of the flagstaff, is displayed, at an elevation of 44 feet above high water, a *fixed white* light, visible in clear weather from a distance of 8 miles. The circuit house and pedestal are painted white.

The anchorage of Purí is easily distinguishable by the Jagannáth pagodas, the flagstaff, and the Government buildings, which are white, and conspicuous from seaward. Vessels approaching Purí roads should not shoal the water to less than 20 fathoms by night, nor stand into less than 8 fathoms off Purí roads by day, as the beach is steep-to. From 8 to 10 fathoms appears a convenient depth to anchor in, south-east of the flagstaff.

THE COAST from Purí trends about E. by N. $\frac{1}{2}$ N. for 26 miles to Churiana, a village about a mile from the sea coast, and near a rather prominent point in lat. $19^{\circ} 54' N.$; it then curves to N.E. $\frac{3}{4}$ E., and at a farther distance of 8 miles, is the mouth of the Devi river, one of the branches of the Mahanadi. The land is low and steep, with from 8 to 10 fathoms in close proximity to the beach, and should be avoided at night or during hazy weather. In the south-west monsoon, a heavy surf breaks upon it, and passing vessels are recommended not to decrease their soundings to less than from 15 to 18 fathoms, and to frequently cast the lead.

Baleswur temple, 8 miles E. by N. $\frac{1}{2}$ N. from Purí is about half a mile from the sea; then, at a farther distance of 7 miles along the coast, is the mouth of the river Kusbhadra, one of the branches of the Mahanadi river.

BLACK PAGODA (Kanarak), in about lat. $19^{\circ} 53' 30'' N.$, long. $86^{\circ} 5' 40'' E.$ in a ruinous state, is still a prominent object on this coast, and sighted by vessels bound to Calcutta during the south-west monsoon. It stands $1\frac{1}{2}$ miles inland, on low, red-looking land, destitute of trees. When seen on the bearing of N.N.E. it appears like a high rock, rising at its eastern end, similar to the gable end of a house. When approaching from eastward it is seen above high barren sandhills. It may be distinguished from that of Jagannáth (Purí) on account of its east side being perpendicular, whilst its west side is sloping. The contrary being the case with Jagannáth pagoda.



Black Pagoda.
(Kanarak.)

Bare sand hills, from 50 to 60 feet high, fringe the coast eastward of Black Pagoda for 5 miles ; then large trees as far as the entrance of Devi river.

DEVI River* (the Goddess).—At a distance of about 18 miles E. by N. $\frac{1}{2}$ N., of the Black pagoda, is the entrance of the Devi river one of the largest branches of the Mahanadi, and formed by the junction of the Great and Little Devi. The Devi flows through a low, level district, and reaches the sea at the east end of a long, narrow, sandy tongue of land, the extremity of which is marked by a beacon. The mouth of the river is surrounded by dense jungle destitute of inhabitants. In 1869, the bar, about 6 cables E. by S. of the beacon on Devi point, had over it 4 feet at low water, and there were breakers east and west of it, extending 3 or 4 cables off shore. To seaward of the bar, at a distance of 3 cables in a south-east direction, is a depth of 8 fathoms, and immediately within the bar, from 10 to 15 feet. In favourable weather and off-shore winds, vessels can anchor outside the river at about 7 cables E. by S. $\frac{1}{4}$ S. from the beacon on Devi point, but with southerly or easterly winds this position would be unsafe.

Within the bar, it is usual to anchor about $1\frac{1}{4}$ miles above or south-west of the beacon on Devi point, in from 16 to 22 feet. A trade in rice is carried on at Machgaon, 9 miles up the Devi.

Tides.—It is high water, full and change, at the entrance of the Devi river at 8h. 15m. Springs rise 6 feet. The tide is felt for 28 miles up the river.

THE COAST from the entrance of the Devi river curves to the N.N.E. for 15 miles to the entrance of the Jotdar river, and consists of low sand islands formed by the numerous streams of the Mahanadi delta. At about 5 miles distant from the Devi river entrance is the town and sand hills of Hurrichpur Gur, about 12 miles N. by E. of which is Kujung Gur, situated about $2\frac{1}{2}$ miles up the Jotdar river. The land about here, known as Kujung point, consists of sand hills, and has sometimes been mistaken for False point, situated about 25 miles to the north-east, by vessels uncertain of their latitude ; it should not be approached nearer than in a depth of 13 or 14 fathoms.

From Jotdar river entrance, the coast, which continues low and sandy, trends about N.E. $\frac{3}{4}$ E. to False point, south-westward of Dowdeswell island, south-west of which island the Mahanadi river has its principal outlet. Kujung bay, thus formed, has regular soundings, and may be approached in safety during daylight with off-shore winds, to as close as a depth of from 8 to 9 fathoms, but as the land is generally covered with haze, great care is necessary.

* See Admiralty plan of entrance to the Devi river, No. 756 ; scale, $m = 3\cdot9$ inches.

MAHANADI RIVER,* (the Great River) has a course of about 520 miles, and receives many tributaries. Situated on the south bank of the principal stream of the delta is Cuttack, where a considerable trade is carried on in the produce of the Orissa district. The rivers of the delta do not appear navigable by sea-going vessels; each has its mouth barred, and is probably subject to frequent changes. The branch of the river that enters the sea about $1\frac{1}{2}$ miles S.S.W. of False point lighthouse, was observed in 1876, to have a long line of heavy surf extending from point to point across its southern entrance. The second or northern entrance, distant $1\frac{1}{2}$ miles E. $\frac{1}{4}$ S. from False point lighthouse, reported to have broken through in 1863, was also noticed to have heavy breakers extending across it. Inside, the Mahanadi river appears to have a navigable channel about 2 cables in breadth, carrying depths of from about 12 to 24 feet. The land at the entrance of the Mahanadi, and near False point lighthouse is low, intersected by numerous creeks, and the sea face is broken up into long narrow islands, joined together by shoal ground.

FALSE POINT LIGHT.†—Near the entrance to the river Mahanadi, or $1\frac{1}{2}$ miles west of Mahanadi point, and about $1\frac{1}{4}$ miles from the sea, is a stone lighthouse painted dark red, with a white star, facing the south-east. The height of the lighthouse is 132 feet, and from it is exhibited, at an elevation of 129 feet above high water an *occulting white* light, dioptric, and of the first order, obscured for *four seconds* once in *every half minute*, illuminating an arc from S.S.W. through west and north to N.E. $\frac{1}{4}$ N., visible in clear weather at a distance of 18 miles. In January, February, and March, heavy fog on the land sometimes obscures the light, and in some instances causes it to show a deep red colour; during these months, vessels when approaching False point should take frequent soundings. The lighthouse should not be approached nearer than in 9 fathoms, which will be found at a distance of $3\frac{1}{2}$ miles, and about 2 miles from the shore. A good guide when closing the land and the light not seen, is to carefully examine the nature of the bottom, and if sand is found mixed with mud, the vessel's head should be put off shore till daylight.

* See Admiralty plan, No. 756, of the entrance to Mahanadi river, scale, $m = 3 \cdot 9$ inches; also Admiralty chart, No. 755, of False point anchorage, scale, 2 inches = nautical mile.

† This lighthouse was established in 1838, when the tower formerly standing on Palmyras point, about 27 miles to the northward, was destroyed by the sea. The first-class light now shown was exhibited in 1880, and converted into an occulting light in 1884. The storm wave of a cyclone swept over False point September 22nd 1885, drowning the port officer and his family, with nearly all the inhabitants. The lighthouse remained intact. It is estimated that an area of 400 square miles was covered with sea water, and 700 villages wrecked. The buildings at Huki-tala, and nearly the whole of Reddie point, were washed away during the storm.

Vessels in the south-west monsoon can communicate with Calcutta by telegraph from False point lighthouse, by hoisting the usual signals of the commercial code. In the north-east monsoon, or with north-east winds, False point should be avoided, it being then a lee shore with generally a westerly current in the vicinity.

FALSE POINT ANCHORAGE * is formed by a tongue of land, extending from False point lighthouse in a north-east direction for a distance of 3 miles, meeting Dowdeswell island (the piece of land named Nurree banga Nassi, not always an island), the north point of which is $6\frac{6}{10}$ miles, N.N.E. from the lighthouse.† The principal feature of this coast is the range of small sand hillocks, averaging in height from 6 to 8 feet above high water, and covered with grass and scrub.

Huki-tala (Hookey Tollah), on the inner shore of Dowdeswell island, is the name given to the harbour master's location, where there is now only a refuge-house, painted white and easily seen from seaward, and a few cocoanut trees.

The outer coast line extends two miles east from the lighthouse and consists of low islands covered with jungle; the shape of these islands is continually changing on account of alteration in the mouth of Mahanadi river.

The inner shore of the bay, extending from False point lighthouse to Bakud creek, embracing what was formerly known as Plowden island, past the entrance to Jambu river and towards Temple point, is principally mangrove. Temple point is a projecting point of trees, $1\frac{1}{2}$ miles north of the Jambu river entrance. From Temple point to the South Broni river the land is low, covered with grass and scrub, with occasional patches of mangrove swamp, fringed with sand, which forms the high water line. Further northward, the sand hills become more elevated, and the mouth of the North Broni creek forms a conspicuous gap between high sand hills. At the distance of 20 miles N.N.E. $\frac{1}{2}$ E. from False point lighthouse, the sand hill of Satbaia (with a solitary clump of trees) forms a good land mark, in case of a vessel getting too near the land when southward of the Palmyras shoals.

Two channels lead inland from the anchorage—Jambu river on the north, and on the south Bakud creek, a short deep branch of the Mahanadi river. Bars intervene between the anchorage and these channels, but at high water, cargo boats and steamers enter with ease. Tidal creeks,

* See Admiralty charts.—False point anchorage, No. 755; the Sandheads, No. 814; False point to Matlá (Mutlah) river, No. 829. False point takes its name from the fact, that formerly it was often mistaken for Palmyras point, 60 miles farther north.

† It was formerly proposed to exhibit a small harbour light, from a wooden structure, at the extremity of Reddie point, N.N.W. of the tripod.

navigable by country boats throughout the year, connect False point with Dhamra and Brahmaní rivers on the north, and with Devi river on the south.

BEACONS and conspicuous marks.—On the north part of Dowdeswell island is an iron tripod, surmounted by a black ball, 40 feet in height, situate $6\frac{6}{10}$ miles N.N.E. from False point lighthouse, but seaward of this, the sand, at low water, runs in a N.W. $\frac{1}{2}$ W. direction for about 800 yards, and is still extending. A small iron beacon, surmounted with a cross, is placed N. 45° W., 565 yards from the tripod; the two in line make a good anchorage mark for deep vessels.

Three-quarters of a mile within Temple point, on the west shore of the bay, is a remarkable tree, the highest in the vicinity, and known as Temple tree, with a pole and black basket projecting from its summit, which bears from Dowdeswell island tripod W. $\frac{1}{2}$ S., distant about 4 miles.

The Jambu location, consisting of a telegraph office, Public Works Department bungalow, and a Customs warehouse, is situated on the left bank of Sunta creek, and is conspicuous from the anchorage. The port officer and the Customs authorities reside here.

Marking the southern entrance point of the South Broni river, is an upright spar with topmast and black cage, situated N.W. $\frac{1}{2}$ W., 4 miles from Dowdeswell tripod, and about 3 miles N. by E. $\frac{3}{4}$ E. from Temple tree.

The only mark of importance on the southern shore is Prince Arthur's beacon, on the sand hills near Prince Arthur's point, consisting of a pole and cage, painted white, and bearing from Dowdeswell tripod S. $\frac{1}{2}$ E., distant $2\frac{7}{10}$ miles.

BUOYS.—**Fairway buoy**, black and white chequered with staff and white cage, lies in $4\frac{1}{2}$ fathoms at low-water spring tides, with Temple tree bearing W.S.W., and Dowdeswell tripod S. $\frac{1}{2}$ W., distant $1\frac{1}{2}$ miles.

Outer western buoy, a black conical buoy, with staff and black cage, lies in 18 feet, N.W. $\frac{1}{4}$ N., 7 cables from the tripod, and indicates the western side of the Fairway channel.

Spit buoy, red can buoy with spire and red cage, lies in 21 feet, N.N.W. $\frac{3}{4}$ W. from Dowdeswell tripod; and indicates the north extreme of the sand spit off Dowdeswell island, and also marks the eastern side of the Fairway channel.

A small red nun buoy, about one cable W.S.W. of the Spit buoy, marks the extreme of the shoal water at the apex of the sand spit.

Four buoys denote the boundary of the inner anchorage; on the western limit are two black buoys, and on the eastern limit, two red buoys; each buoy lies in about 12 feet at low water.

Anchorage.—The best anchorage for large vessels is northward of Dowdeswell island, in 4 fathoms mud, with tripod beacon and cross beacon in line, bearing S.E., distant 6 cables, or about midway between the outer western buoy and the small red nun buoy, at the apex of the sand spit.

In the inner anchorage vessels can take up any position between the buoys marking the channel.

In 1883, a general silting up of the channels in the harbour seemed to be taking place, and where formerly there was a clearly defined channel, extensive flats of mud and sand now exist which uncover at spring tides. This is especially the case in the channels leading to Bakud creek and the lighthouse, the latter of which is not navigable for boats at low water.

TIDES.—It is high-water, full and change, at the inner anchorage off Huki-tala at 9h. 15 m. ; ordinary springs rise 7 feet, neaps 4 feet. The range of tide is much affected by the fresh water out of the numerous creeks, and also by the prevailing winds ; the highest tides occur during the south-west monsoon, the lowest in the dry season. The tidal streams within the harbour set fairly through the several channels, and at springs average a velocity of two knots an hour. After heavy rains, when the freshets come down Bakud and Jambu rivers, the ebb stream, which runs out round Reddie point, sometimes attains a rate of 4 or 5 knots an hour.

At half a mile outside and eastward of Reddie point, the flood stream sets to the north ; at the Fairway buoy to the north-west ; whilst midway between the buoy and Reddie point, it sets to W.S.W. Great attention, therefore, is necessary in entering the port on a flood tide.

In the offing, the flood sets to north-east, the ebb to south-west, at a rate of about one knot per hour ; but the velocity is much influenced by the prevailing wind, so that the flood stream (augmented by the current) in the south-west monsoon attains sometimes a rate of 4 knots.

Supplies.—Good water can be procured at the canal lock, about one mile up the Jambu river, by using the vessels' boats. Firewood is plentiful and cheap.

Provisions are scarce and expensive ; sheep and vegetables can be obtained from Cuttack, and from villages within a radius of 20 miles ; but it is better to obtain all provisions from Calcutta by means of the weekly British India steamers.

Trade.—False point is the principal port of Cuttack and the Orissa district, with which it is connected by the Kendrapara canal by way of Bakud creek and Marsaghai, the imports are chiefly Birmingham and Manchester goods ; exports, rice, and various seeds. Value of trade about 261,212*l.*, chiefly with other Indian ports.

Ballast must be discharged outside the limits of the port.

DIRECTIONS.—Vessels from the southward, bound to False point outer anchorage in the south-west monsoon, on approaching the lighthouse, should not shoal into less than 10 fathoms. When the lighthouse bears N.W. distant $4\frac{1}{2}$ miles, in 10 fathoms, olive mud bottom, alter course to N.N.E. for about 7 miles, or until the tripod on Dowdeswell island bears N.W. $\frac{1}{2}$ W. Thence a N.W. by N. course for about $3\frac{1}{2}$ miles will place a vessel in about 7 fathoms, mud, one mile off shore, with Dowdeswell tripod bearing southward of West. Haul in gradually until Temple tree, the Jambu location buildings and flagstaff, on the west shore of the bay, are well open to the northward of Dowdeswell island and anchor as convenient.

If proceeding to the inner anchorage, pass westward of the red spire buoy off Reddie point (taking care to guard against an eddy extending from the pitch of the point to the 3-fathom line), and steer up the harbour keeping black buoys to starboard and red to port to the required anchorage.

With a strong flood stream (which will show itself by drifting a vessel rapidly to the northward), it will be found best to steer in on a southerly course, bringing the vessel's head through the S.E. quadrant, to east and north-eastward, so as to breast the tide before anchoring. Instances have occurred of steam vessels steering in towards Reddie point, and attempting to turn to starboard, or through south-west and north-west, on the flood tide; thus they were rapidly swept across the channel to the westward, and grounded in the shoal water extending from Temple point.

From abreast Huki-tala, boat channels, winding through mud-banks and partially buoyed, lead to the Bakud and Jambu creeks. There is also a channel, available for boats, through mud flats and mangrove, leading to False point lighthouse, the banks on either side being marked by bamboos. The channel to Jambu is the deepest, and at high-water is navigable for vessels of 10 feet draught. Bakud channel, although shallower than Jambu, is at present the highway to Cuttack. In navigating these channels, it is recommended that the services of a local pilot should be obtained, as they alter from time to time, necessitating frequent changes in the position of the buoys and bamboos which denote the fairway.

A vessel proceeding from the Húgli river to False point should not bring the Palmyras buoy to bear North of N.N.W., until 5 miles south of it, when she may shape course for False point, without getting less than $5\frac{1}{2}$ fathoms. Steamers are liable to get the flood tide on the port bow during strong southerly winds and are set inshore towards the coast near Satbaia sand hill, they should never shoal under 9 fathoms.

FALSE BAY.*—From the land on the west side of False point anchorage, the coast, trending N.E. $\frac{1}{2}$ E. for 19 miles to the entrance

* See Admiralty chart, No. 814, The Sandheads, False point to Matlá river; scale 1" = 0.26 inches.

of the Maipara river and forming False bay, is moderately high, consisting of sand hills, but from Maipara point northward it is quite flat. About midway between False and Palmyras points, Satbaia sand hill, with an isolated clump of bushes at its north-east end, affords a good landmark.* In False bay, the bottom is soft olive green mud, with regular depths decreasing gradually to the shore; but in the northern part of the bay, the nature of the bottom changes from soft mud to a mixture of sand and mud, with rotten stones and broken shells, towards the southern edge of the sand banks, which extend seaward of the mouth of the Maipara river and Palmyras point.

Caution.—On nearing False point from the eastward the water shoals gradually, but in approaching the shoal ground extending eastward from Palmyras point from the same direction, the water shoals suddenly from 13 to 9, 6, and 4 fathoms.

MAIPARA RIVER is the southern outlet by which the waters of the Brahmaní enter the bay of Bengal about 5 miles south of the Dhamra river. Bansgarh, a tidal creek of the Maipara runs south-west parallel to the coast till it enters the sea about 6 miles north of False point harbour. The entrance of the Maipara river is deep, but blocked by flats, which can only be crossed by boats at half tide in smooth water; from November to March native craft engaged in the rice trade frequent the river.

Maipara Sand (Mypurra).—At the mouth of the Maipara river is (1885) an extensive sand bank, which trends $3\frac{3}{4}$ miles to the north-east, drying at its eastern extreme, and having two gaps through it. Boats may pass through the gap close to Maipara point (about one mile off) but care must be used as blind rollers are frequent. From the extreme of Maipara sand, shoal water extends in ridges east and north-east for $6\frac{1}{2}$ miles. The eastern ridge in long. $87^{\circ} 12\frac{1}{2}'$ E. trends north and south, and has $3\frac{1}{2}$ fathoms with 11 fathoms close outside it. The southern end of this ridge with 5 fathoms is in lat. $20^{\circ} 40\frac{1}{2}'$ N.; the northern end, with 4 fathoms (1885), bears S.S.E. distant one mile from Palmyras buoy.

PALMYRAS POINT, called by the natives Maipara, from the contiguous river of the same name, is the eastern ending of the low land, in reality an island which separates the rivers Maipara and Dhamra. The whole of the land hereabouts is low with many palmyra trees. The coast of Palmyras point curves gradually to the north and west to the south-east entrance point of the Dhamra river, which is low, covered with dark jungle, and difficult to distinguish. The palm tree which formerly stood upon this point, and formed a useful mark from seaward, has fallen from decay. A considerable mud bank fringes the coast, drying at low water as far seaward as a distance of 2 miles.

* Commander A. D. Taylor (late I.N.) 1885.

Anchorage* may be had when a north-wester is blowing with the north end of the sand hills on Maipara point bearing N.W., distant 3 miles in 7 fathoms, mud and sand.

In a south-west gale there is excellent anchorage in 7 fathoms, mud, with Kanika buoy bearing S.W., distant $1\frac{1}{2}$ miles.

CURRENT.—In making up the coast from False point for the Húgli or Balasor, remember that Palmyras shoals form a dangerous promontory, round which the tidal streams at springs, set with a velocity of 2 knots, being swiftest in the deeps between the shoals. Near Palmyras buoy the flood sets about N.W. and will carry a vessel inshore; the ebb sets in the opposite direction. At Kanika buoy the flood varies in direction and sets N.N.W. to W.N.W., and the ebb S.E. by S. to South. At the south end of the Palmyras shoals the flood stream sets North, the ebb South.

DHAMRA RIVER,† the most important of the navigable rivers of Orissa, forms the northern exit of the united streams of the Brahmaní, Kharsua, and Baitarani rivers. The inner bar of the river changes both in depth and position; but the outer bar, to the north of Shortt island, maintains fairly well its position and depth of water. A vessel of 20 feet draught may navigate as far as the village of Dhamra, 11 miles above the outer bar, and 16 feet can proceed as high as Chandbali at high tide, and with the aid of a pilot.

At about 9 miles from its mouth, the Dhamra branches into two streams, that to the north, on which are situated the towns of Chandbali and Jajpur, is called the Baitarani, and follows a westerly direction; that to the south, termed the Brahmaní, takes a south-westerly direction, and communicates with Cuttack. At about 6 miles above the Baitarani junction, the Brahmaní river connects with the Maipara, and about 3 miles higher receives the Kharsua river, which again connects with the Baitarani above Jajpur.

APPROACHES.—Nearing Dhamra river from the south-east, caution is necessary to avoid Palmyras shoals, which extend to a distance of about 12 miles from the coast, and are steep on their eastern face. A vessel should not stand into less than 12 fathoms, as the water shoals suddenly from 8 to 2 fathoms. When near the shoals, the bottom is hard or sandy, whilst northward the bottom is mud. In clear weather the Nílgi hills will be seen, which should be steered for on a N.W. bearing; and when the water shoals to 12 or 14 fathoms, with mud bottom, a course about S.W. should be steered for Kanika buoy, and thence for the red

* Commander A. Carpenter, R.N., 1885.

† See Admiralty chart of the Dhamra river, No. 754, scale, $m = 3$ inches.

H buoy at the entrance of the south channel. Besides Palmyras buoy, which is white, with two horizontal red bands, moored in 11 fathoms, a beacon may be noticed on Shortt island; but the lead should be kept carefully going, and unless certain of position, no stranger should stand into less than 10 fathoms. A vessel overtaken by night should anchor when bound for the Dhamra, if Shortt island beacon, or either Palmyras or Kanika buoys are not recognisable.

Shortt island is an extensive sand bank, $2\frac{1}{2}$ miles in length by $1\frac{1}{3}$ in its broadest part, and will be the nearest land sighted when entering the Dhamra river. Creepers and grass cover the south side of Shortt island. No fresh water can be obtained.

Beacon.—On the western part of Shortt island, at about $8\frac{1}{4}$ cables from the extreme point, is a beacon with a black basket 50 feet above high water, which can be discerned in fine weather from a vessel's deck at a distance of about 5 miles.*

TIDES.—It is high water, full and change, at Shortt island at 9h. 44m.; at Kanika bank at 9h. 30m.; and at Chandbali at 11h. Springs rise $9\frac{1}{2}$ feet, and neaps 6 feet. Stream of spring tides runs 2 to 3 knots, increasing to 4 knots with the freshets.

Kalibhanj island trending east and west, is $5\frac{2}{3}$ miles long by about $\frac{2}{3}$ of a mile in breadth, and divides the Dhamra river into two channels, at about 7 miles from the outer bar entrance. The northern is the navigable channel.

Dhamra village, on the north bank of the river, 10 miles above Shortt island, consists of a few straggling houses. A custom house is situated here, and a tide-pole indicates the depth of water likely to be met with on the Chandipal or inner bar.

Matai River, which joins the Dhamra river at about a mile westward of Dhamra village, is about a cable wide and navigable at low water for craft of 8 feet draught.†

BUOYS.—**Kanika buoy** is black, with the letter K painted white, surmounted by two circular discs and staff. It is moored in 23 feet, and bears from Shortt island beacon N. 12° E., distant $2\frac{1}{2}$ miles. Vessels should keep it to the northward when entering the Dhamra river.

* A wooden spar, 47 feet high, has been newly erected on Shortt island, one third of a mile E.S.E. from the old beacon. On completion, a few months hence, of the light-house now in course of erection on Shortt island, the beacon will be removed. (Port Officer, Calcutta, March 1886.)

† In the coast canal in course of construction to connect Cuttack with Calcutta, the Matai river is utilised as one of the natural connecting links, the junction occurring about 14 miles above the position at which the Dhamra and Matai rivers join.

Bar buoys.—F is a conical buoy, red, surmounted by spire and basket of same colour. It is moored in 11 feet, and bears from Shortt island beacon N. $\frac{1}{2}$ W., distant $1\frac{3}{4}$ miles, and marks the western limit of the bar.

E is black, surmounted by spire and basket of same colour, in 10 feet, and bears from buoy F, S. 58° W., distant $8\frac{1}{2}$ cables.

D is a can buoy, red, in 16 feet. To the northward, and between it and buoy E, the north and south channels converge, and here depths will be found at low water, of 14 and 15 feet, mud. From it, Shortt island beacon bears E. $\frac{1}{2}$ S. distant rather more than a mile, and it is about 3 cables distant from the west point of Shortt Island.

C is conical, black, with staff, on the north side of the channel about midway between Shortt island and Kanika bank. It bears from Shortt island beacon W. $\frac{1}{4}$ N., distant 2 miles.

B is a can buoy, red, with staff and cage of same colour. It marks the south side of the channel southward of Kanika bank, and bears from C buoy S. 76° W., distant 2 miles.

Buoy A is conical, black, with staff and cage of same colour. It marks the north side of the channel southward of Kanika bank, from the highest part of which it bears S. 53° W., distant half a mile.

Inner Bar Buoys are conical; that on the south side of the channel red, that on the north side black. They bear from one another N.N.W. and S.S.E., distant $1\frac{1}{2}$ cables, and from Palmyras point, the south or red buoy bears N. 17° E., distant $5\frac{1}{4}$ cables. Depths of 12 to 14 feet at low water will be found between the bar buoys just described. From the inner bar, the channel, to abreast Dhamra village, continues clear of danger. Vessels drawing 20 feet may anchor off Dhamra.

Palmyras buoy, a guide for entering the Dhamra from the southward, and for clearing Palmyras shoals, if bound to Balasor or the entrance to the Húgli, is a white beacon buoy with two red horizontal bands, surmounted by staff and circular red disc. It is in 11 fathoms at low water, and bears from Shortt island beacon N. 73° E. distant 7 miles, and from Kanika buoy S. 86° E., distant $6\frac{1}{4}$ miles.

PALMYRAS SHOALS protruding off the Dhamra and Maipara rivers, extend for $7\frac{3}{4}$ miles to the southward of Palmyras buoy, or to lat. $20^{\circ} 40' N.$ Their outer edge (1885) was in long. $87^{\circ} 13' E.$ Depths of $4\frac{1}{2}$ and $3\frac{1}{2}$ fathoms, hard sand, were found one mile and $2\frac{1}{2}$ miles respectively S.S.E. of Palmyras buoy, with 11 fathoms outside them.

Buoy H marking the south side of entrance over the outer bar of the south channel into the Dhamra river, is red and conical, with staff and cone. It bears from Shortt island beacon N.E. $\frac{1}{2}$ E., distant $1\frac{1}{2}$ miles. The letter H is painted on it in white.

Buoy G is black, wooden, conical, and surmounted by a black cross. The letter G in white, is painted on this buoy, which bears N. 11° W., distant $8\frac{1}{2}$ cables from the beacon on Shortt island. The depths near G buoy at low water are from 14 to 16 feet.

A small shoal of 8 feet at low water, lies $3\frac{1}{2}$ cables E. $\frac{1}{2}$ N. of G buoy (1885).

DIRECTIONS.—South channel.*—When near to H (red) buoy, the coast shows as a low dark line of trees. A gap is visible bearing W. by S. which is the entrance south of Kalibhanj island. Immediately north of the gap Kanika beacon will be seen on a sand bank in front of the trees. The entrance north of Kalibhanj island does not show as a gap until close to D buoy.

In 1885, the course in to the Dhamra from Palmyras buoy was W. $\frac{1}{2}$ S., ships should not get southward of that line. Bring G and D buoys in line on a S.W. $\frac{3}{4}$ W. bearing, and so continue until close north of G buoy, when alter course to about S.W. by W. $\frac{1}{2}$ W. or so as to pass about 2 cables south of C buoy (black), in this track 11 feet will be the least depth found at low tides; then bring B buoy (red) well inside the south extreme of Kalibhanj island and steer right up to it in that position, then cross towards A buoy (black) on a N.W. by W. $\frac{3}{4}$ W. course, passing close south of it, and thence for the northern (black) buoy of the inner bar on a W. $\frac{1}{4}$ N. course, which will lead over the inner bar in 13 feet.† Now edge away on a S. 72° W. course for about a mile, or until Chandipal tree bears N. 31° W., when alter course to W. $\frac{1}{2}$ N. or with the distant north and west extremity of Kalibhanj island just open north of Kalibhanj perch. Pass the perch at a distance of a cable, and steer along, and about $1\frac{1}{2}$ cables from the north coast of Kalibhanj island, until Dhamra village bears N.W. $\frac{1}{4}$ N. distant a quarter of a mile. This is the anchorage for large vessels.

North channel has 8 to 9 feet at low-water springs. Pass close south of Kanika buoy (black) on a S.W. by W. $\frac{1}{4}$ W. course, and when about 2 cables N.N.W. of F buoy (red), alter course to S.S.W. $\frac{1}{4}$ W., or with D buoy (red) right ahead, and steer for it; when about 3 cables distant from D buoy, alter course to S.W. by W. $\frac{1}{2}$ W., or so as to pass 2 cables south of C buoy, and proceed from this point as advised for the south channel.

Continuing to Chandbali, bold water will be met with at a cable's distance from the north bank, from abreast Dhamra village to about $1\frac{3}{4}$ miles westward of the mouth of the Matai river, when the Celerity spit,

* Commander A. Carpenter, R.N.

† The positions of the buoys are for 1885, they are occasionally moved as the channels alter.

marked on its south side by a black buoy, and which joins the bank extending from the western extremity of Kalibhanj island, will be reached, and the perch on Round point, on the south side of the river sighted.

Celerity spit frequently changes, and should not be crossed without a pilot, whose services should be retained for the upper part of the river and for the Baitarani to Chandbali.

BAITARANI RIVER, meaning "difficult to cross," enters the Balasor district at the village of Batipur, and flows for 45 miles in a south-west direction till it joins the Dhamra 5 miles from its mouth. It forms the boundary between Balasor and Cuttack, and receives two tributaries, the Salnadi and the Matai. The country near the Baitarani is largely cultivated with rice, the jungle which marks the banks of the Dhamra being lost sight of. The entrance of the Baitarani is split into two channels by Luchinarian island, which is about half a mile in length by a quarter of a mile in breadth. Of these, the northern is the navigable channel carrying depths of 20 feet at low water. The southern channel is only available for boats.

Jhuta bar* is an under water continuation of the west point of Luchinarian island with Pilot island, situated about half a mile to the southward. A depth at low water of from 8 to 9 feet may be found on Jhuta bar.

Pilot island, southward of the Jhuta bar, is low and extends $11\frac{1}{2}$ cables N. by E. and S. by W. Sand flats extend from its north and south points, and between it and the left bank of the Baitarani river, is a narrow boat passage. The navigable channel lies between Pilot island and the eastern bank, the best track being nearer to the eastern bank. This part of the river is known as Pilot reach; a black buoy marks the south-west extreme of the spit extending south-west from Pilot island.

From the black buoy near the western end of Pilot reach, the river turns at right angles round Palmer point. On the western side of this part of the river is Sickie island. Between Sickie island and the western bank is a narrow boat passage.

A red buoy marks the western under water limit of Sickie island. The navigable channel, which is about a cable in breadth, carries 25 to 27 feet, lies close to the eastern side of the river, and curving to the westward changes over to the southern side at Sickie point, which forms the eastern boundary of Long reach.

Long Reach runs in a westerly direction for about 2 miles, and around Borarria point, which is low. The north part of Long reach terminates in Hurripur bar, having on it 8 feet at low water.

* Only $6\frac{1}{2}$ feet were found in the best track over the Jhuta bar in April 1886. (Reported by the port officer at Chandbali).

Hurripur reach has a northerly trend, and carries from 14 feet on the eastern side of its channel, to 20 and 25 feet farther north. The deepest water in this reach lies mid-stream. The latter part of the reach trends to the westward round Love point, towards which the deepest water lies.

Love point bar extends between Love point and Chandbali, and carries from 7 to 8 feet. A course of W. $\frac{1}{2}$ N. for 11 cables from Love point leads in the deepest water, a quarter of a cable from the southern or right bank up Love point reach, until travellers' bungalow bears North, distant about a cable. The three piers of Chandbali may now be distinguished, and anchorage picked up, in from 22 to 30 feet, off the town.

CHANDBALI is considered within the limits of the port of Dhamra. Of late years it is said to have risen in importance, and to have an improving trade. There is a police station, travellers' bungalow, and customs office with warehouse, and three landing piers.

Communication with Calcutta by steamer and with Cuttack takes place twice a week. Native sailing vessels do not, as a rule, frequent Chandbali, preferring the Matai river, a tributary of the Dhamra, for picking up their rice cargoes, as affording greater advantages in its course through a rice producing tract.

Trade.—Supplies of fresh provisions can be procured in small quantities at Chandbali. The export consists almost entirely of rice. Large numbers of coolies are brought from Calcutta by steam vessels, for employment in the rice fields. In this respect brisk competition goes on. In 1881-82, the number of vessels that entered the Dhamra was 188, of 48,187 tons. The total value of trade was 7,748,434 rupees.

Gwire point, a sharp tongue on the south side of the river, opposite to, and about half a mile westward of Chandbali, terminates Love reach. Here the river turns sharply to the south-east, and continues navigable for the same draught of water that has reached Chandbali, for 2 miles.

A red buoy marks the termination of the shoal water off Gwire point, and in ascending the river, should be kept on the port hand.

Mahurigaon, situated 2 miles above Chandbali, on the opposite side of the river, has of late years fallen off in importance.

CHAPTER V.

COAST OF BALASOR, RIVER HÚGLI, SUNDARBANS, GANGES
BRAHMAPUTRA AND MEGHNA RIVERS, WITH CHITTA-
GONG COAST.

Variation 2° 40' to 2° 50' East in 1887.

THE COAST from the north entrance point of the Dhamra river trends North for 4 miles to Balisai point, which is sandy, and in this vicinity the encroaching sea has detached several banks; the flats extend well out, and a depth of 3 fathoms will be found 6 miles eastward from the shore. The coast then trends N.W. by N. for 13 miles to Bidiapur and is low, muddy, and wooded with small scrub. Off Bidiapur the coast has retreated of late years, and landing is difficult owing to the softness of the mud. About 3 miles north of Bidiapur the coast again trends to the north-east, and as far as Kalikoti, is flat and faced with low mangroves. Off Kalikoti, the 3-fathom line is $5\frac{1}{2}$ miles from the mangrove edge, and the bottom is of soft olive coloured mud.

Nauri is situated 11 miles N.N.E. of Kalikoti, the soundings off it being mud and sand. A small stream, the Gammai, enters the sea one mile south of Kalikoti, and another debouches just south of Nauri. Both are inaccessible at low water to anything but small boats.* The Calcutta coast canal to Cuttack is in course of construction a few miles inland and nearly parallel to this coast, and will connect with these streams. At Nauri the coast becomes firm with higher trees and sand hills, and so

* Churaman, formerly an extensive river port, but now of little importance, is situated on the Gammai river, a branch of the Kansbans. The mouth of this river is silted up and concealed from seaward by a dense fringe of jungle. Vessels of 45 tons can enter at high water. The trade is carried on by small boats to vessels anchored in the offing. Laichanpur, also a small river port on the Kansbans, is about 5 miles northward of Churaman. The river is not navigable, the rice sloops taking in cargo at their anchorage about 5 miles from the entrance. Some come as near the coast as the high tide permits, and at low water are left resting on the soft mud. Churaman and Laichanpur supersede Balasor roadstead after February as shipping ports for rice, the anchorage about 6 miles eastward of them being better protected from the strong southerly winds by Palmyras shoals. On the contrary, during the north-east monsoon, ships do not load at these ports, but at Balasor. In 1873-74 the value of exports from Laichanpur and Churaman amounted to 13,831*l*. (*Commander A. D. Taylor, late I.N., 1885.*)

continues for 10 miles to Chandipur near the Balasor river. About half way between Nanri and Chandipur a large double pagoda shows out amongst the trees when viewed from the south-east.

BALASOR ROADS, in the north-west part of the bay of Bengal, are resorted to in the north-east monsoon by vessels for cargoes of rice brought down the Burabalang river. The largest vessels which ascend to Balasor or receive their full cargo in the river are of about 4,000 maunds (145 tons) burden.

The best mark for making the anchorage is the highest part of the Nilgiri hills, situated $15\frac{1}{2}$ miles inland, bearing about W.N.W. The holding ground is stiff mud, and the best anchorage for a vessel of 20 feet draught will be found with Chandipur flagstaff bearing N. 66° W., highest peak of Nilgiri hills N. 81° W., and the beacon on the north bank of the entrance to the river, N. 51° W. This position will place a vessel about $5\frac{1}{4}$ miles off shore, and $2\frac{3}{4}$ miles from the anchoring buoy, in 4 fathoms at low-water spring tides.

The coast near the mouth of the Burabalang, appears from the offing, sandy and barren. About 4 miles northward of the entrance, sand hills of mottled grey and yellow colour will be noticed, while on the fringe of low sand hills to the southward of the river, and bordering the coast, Chandipur flagstaff, near a large white bungalow, can be recognised.

BURABALANG RIVER * (the Old Twister) rises among the Morbhanj hills, and after receiving the Gangahár and Sunai wriggles into the sea in about lat. $21^\circ 28'$ N., long. $87^\circ 5'$ E. The tide runs up 23 miles. Native craft and steamers of nine feet draught can navigate as far as the town of Balasor, or about 16 miles. Jimkhana bar, about a mile below Balasor, is an obstruction, extending between sand banks, and carrying over it from one to two feet at low water. The entrance of the river, 400 yards in width, is almost closed by a bar reaching as far seaward as 2 miles from the river entrance, and which had over it, in 1883, at low-water spring tides, 2 feet of water, and with a south-east wind, was observed to break right across. The last quarter, flood, is the best time for crossing.

Chandipur flagstaff bears S. 44° W., distant 1 mile 7 cables from the beacon on the north bank of the Burabalang river. It stands on a sand hill which is 53 feet above sea-level.

Beacon.—On the north entrance point of Burabalang river, is a wooden spar painted *white*, with a basket, 35 feet above the ground.†

* See Admiralty plan of Balasor or Burabalang river, No. 239; scale, 'm = 1.95 inches.

† This beacon is instead of the single palm tree which formerly stood on the north entrance point of Burabalang river, but which has been washed away (April 1886).

LIGHT.—A *fixed white* light is shown from Chandipur flagstaff from sunset to sunrise, elevated 106 feet above the sea, and visible from a distance of 5 miles, between the bearings S.W. through West to North.

BUOYS.—In 1883, the following were the buoys at the entrance of the Burabalang river.

Anchoring buoy, black, with staff and cage. On one side an anchor, and on the opposite letter B, painted white. The depth at low-water spring tides at this buoy is 18 feet, and it bears from Chandipur flagstaff on the sand hills bordering the coast on the south side of the entrance of the river, S. 53° E., distant nearly 4 miles. By noting the depth at the anchoring buoy and comparing with the chart, the depth on the outer bar and in the river generally may be estimated.

A red buoy is moored in 9 feet at low water, with Chandipur flagstaff bearing N. 53° W., distant 2 miles $4\frac{1}{2}$ cables.

A white buoy with staff and cage, lies with Chandipur flagstaff N. 67° W. distant $2\frac{6}{10}$ miles, and Elfin flat buoy open north of Chandipur flagstaff.

A red buoy, known as Elfin flat buoy, from the shoal it is intended to mark, lies in 4 feet at low water, with Chandipur flagstaff bearing N. 70° W., distant 1 mile and half a cable.

A black buoy, termed the “inner bar buoy,” in 5 feet at low water, with Chandipur flagstaff bearing S. 72° W., distant 1 mile 2 cables.

A tide gauge is placed $5\frac{1}{2}$ cables westward of and inside the entrance of the Burabalang river; it is near the south or right bank, and about a cable westward of it is the landing pier, connecting with the road which leads to the town of Balasor.

DIRECTIONS.*—From anchoring buoy steer for the beacon on the north entrance point of the river on a N. 26° W. bearing until the second red buoy is seen just open northward of Chandipur flagstaff, with the latter bearing N. 68° W., when alter course for Chandipur flagstaff with the red buoy left open. This will lead in the deepest water over the bar, care being taken, if the flood tide be making, not to be set to the northward of the leading mark.

When the inner bar buoy, black, comes in line with the beacon on the north entrance point of the river, keep these in line on a N. $\frac{1}{4}$ E. bearing, and pass on the east side of the black buoy; after passing which, alter course to N. by E., for half a mile, and then steer about N. N.W. $\frac{1}{2}$ W. for the entrance of the river. This leads in the deepest water until abreast the beacon; the best course then, along the first reach which trends W. by N., is at about a cable's distance from the northern bank until

* In 1883, but the bar is liable to change.

abreast Chota Ghira point, where the river takes a sharp turn to S. by E., and it is advisable, in a steam-vessel, to slow the engines and use plenty of helm.

The channel, after passing Chota Ghira point, is near the east bank of the river. This second reach runs S. by E., gradually curving round to S. by W., and is $1\frac{1}{4}$ miles in length. The central part is comparatively shoal, having depths, for half a mile, of 9 and 10 feet at low water.

Third reach doubles back on the second reach, running for a mile N. by E., then turns at right angles to the westward round Ghentí point. The channel, which in the second reach and bend has been near the western and southern shore, or right bank, in the third reach changes to the eastern shore, or left bank. The southern part of the third reach has from 9 to 10 feet of water.

The fourth reach pursues a serpentine, but on the whole, westerly course, and at 7 cables westward of Ghentí point is obstructed by Dinga bar. Between this bar and the northern bank the depth at low water is from 6 to 7 feet; and it is necessary to pick the way by means of the lead, borrowing throughout in the fourth reach, after passing Ghentí point, on the north shore of the river. Dinga bar passed, the channel changes over to the south bank, and has depths of from 14 to 22 feet, until Whoarguddí is approached, where depths of 10 and 11 feet will again be found unavoidable.

Jungle point is the extremity of the peninsula, near Whoarguddí. The river here takes a sharp trend to the eastward, its general direction throughout the fifth reach being E.S.E. for $1\frac{1}{4}$ miles. This, the fifth reach, carries in its deepest channel depths of from 9 to 12 and 18 feet. Rounding Chargutia point, the river now enters sixth reach, extending in a westerly direction for $1\frac{3}{4}$ miles, terminating at Bubur point. The first part of the sixth reach has a north-westerly trend for 6 cables, where a detached sand bank, dry at low water, is half tucked into a hollow in the northern bank. The depth of the navigable part of the river in the sixth reach is from 3 to 10 feet, the channel passing south of the detached sand bank and then crossing to the northern bank. The deepest part of the river in this part of sixth reach is mid-stream between the sand banks, and then towards the northern shore; again crossing to the south shore, as Bubur point is approached.

Seventh reach maintains a northerly trend, and extends for a mile. A sand bank, 4 cables long, by three-quarters of a cable broad, blocks up the greater part of it. On the east side of this sand bank is a narrow channel carrying 3 feet. The navigable channel lies on the west side of the sand bank, carrying depths of 3 feet. This part of the river is known as Bubur bar. The river from seventh reach winds round Nudiafa

point assuming a south-westerly trend for a mile to Pukarabhar, then a direction of W. by N. for 7 cables to Jimkhana, and again a south-westerly trend for $5\frac{1}{2}$ cables, which brings a vessel to Muhammad Pau, which is the last point before Balasor port is reached.

Midway between Pukarabhar and Jimkhana, is Jimkhana bar of sand, over which, at low-water spring tides, is a depth of one foot.

About two cables north-east of Muhammad Pau point, the channel of the river changes over to the south bank, and from this position on to the custom house at Balasor, or a distance of 3 cables, continues near the Balasor or right bank of the river. Depths here will be found to vary between 10 and 22 feet at low-water spring tides.

BALASOR PORT, about three-quarters of a mile in length, fronts the town of Balasor. With the custom house bearing S.W., off Balasor, 10 feet at low water may be relied on, but the river here is only half a cable wide, and a vessel must moor head and stern.

Trade.—In the year 1881-82 the number of vessels that entered Balasor port and roads was 185 of 23,193 tons. Value of exports was Rs. 940,812, of imports Rs. 722,485.

The town of Balasor, established in 1642, was the site of one of the earliest English settlements in Eastern India. The original factory at Pippli (1634) was transferred to Balasor owing to the silting up of the Subarnarekha river. Balasor began to decline in importance as its younger rival on the Húgli gradually grew from a cluster of mud huts into the Calcutta of to-day.

TIDES.—In Balasor roads the ebb tide sets to the south-west, flood to the north-east; at spring tides about 2 knots an hour. It is high water, full and change, at the entrance of Burabalang river at about 9h. 45m. Springs rise 12 to 13; neaps 8 feet. Off Balasor custom house at about 11h. Springs rise 10 and neaps 6 feet 6 inches. The stream of ebb is felt for 8 or 9 hours, and runs as much as 4 knots an hour; that of flood is feeble, averaging about half a knot.

Supplies for vessels lying in Balasor roads can be procured by special arrangement, either with the owners of cargo boats, or with the masters of the small steam-vessels which ply weekly to Calcutta. The river water off the town of Balasor at half ebb is fit for drinking purposes.

There is telegraphic communication with Calcutta and Cuttack.

Cyclones.—From the position of Balasor roadstead, it is exposed to the full brunt of cyclones. Many disasters caused by these storms are on record. October 31st, 1831, the storm wave accompanying a cyclone breached the trunk road to Calcutta, at a distance of 9 miles from the coast, and 26,000 people lost their lives. Native craft approach the coast as near as high water will permit. Should a storm come on it is said they have

little to fear. Doubt arising as to weathering a storm, the best plan is to run a vessel into the western part of Balasor roads, near Churaman, some 20 miles south of the entrance to the Burabalang river entrance, where the liquid mass of mud held in solution affords the best possible non-conductor to the violence of the sea.

Chanuya and Sartha are small ports on the Panchpara river, the mouth of which is 4 miles north-east of Balasor roadstead. The river bifurcates just within the entrance, and Chanuya village lies about 5 miles up the western, and Sartha about 8 miles up the eastern, branch. The bar has only about a foot at low tides, but within there is plenty of water, and native vessels of 100 tons burden enter, and ascend as far as Mahadani, 9 miles from the sea. Exports consist of rice and paddy.

THE COAST from the entrance of the Burabalang (Balasor) river trends N.E. $\frac{1}{2}$ E. for 4 miles to the outlet of Panchpara river, and then bends round for $12\frac{1}{2}$ miles in an E.N.E. direction and has several sand hills, to the mouth of the Subarnarekha river, off the entrance to which is Pippli sand, which dries at a distance of 2 miles from the shore.

SUBARNAREKHA PORT, the site of the first maritime English settlement in Bengal, is now insignificant and almost choked by sand banks. On the western side of the entrance to the river stands a pagoda and tope of trees. The channel, nearly dry at low water, is on the south-west side of Pippli sand. The river is said to be fairly deep within, and navigable for country craft for about 16 miles. During the rains, rice boats of 2 tons penetrate far into the interior up the Subarnarekha, which has a tortuous course of 317 miles. On the eastern bank about 20 miles from the sea is Jaleswar (Jellasure). The port is principally visited by fishing boats, which in fair weather issue out in squadrons and sail down the coast as far as Purí.

Anchorage may be had off the mouth of the Subarnarekha river in 5 fathoms mud, eastward of Pippli sand, with the pagoda bearing N.W. by N., distant 8 miles from the shore.

THE COAST, eastward of the entrance to the Subarnarekha river consisting of sand hills, trends E. by N. for about 10 miles to the Birkul bungalows; between is a sand hill known as the Quoin. At a distance of 3 miles eastward of Birkul bungalows is the mouth of the shallow stream Digwah Mohan, and at 4 miles farther the entrance to Munder Mohan, a similar stream. Various creeks, including Sola creek, then occur, until the mouth of Rásulpur (Hijili) river is arrived at. The whole of this extent of coast is low and without objects recognisable at any distance from the offing. The small vessels that frequent Rásulpur river, in their passage from the westward, use a narrow channel close inshore, which has depths of from 3 to 6 feet, but requires local knowledge.

COWCOLLI LIGHTHOUSE,* on the west side of entrance to the Húgli river, is situated north-east of the entrance to the Rásulpur river, about $2\frac{1}{4}$ miles S.S.W. of Khijirí tidal semaphore, and about 7 cables inshore. It shows a *fixed white* light illuminating an arc of 56° , between N. by W. and W.N.W.; the lantern is 62 feet above high water, and the light is visible in clear weather from 10 to 12 miles. The lighthouse is built of brick, painted white.

PILOTS RIDGE is the bank or shelf which borders the coast off False and Palmyras points in the direction of the entrance to the river Húgli, and affords an excellent guide for vessels approaching the river, as the bottom to 20 or 23 fathoms consists of shelly sand and gravel of a reddish colour; while more to the east or seaward, it is of sand and mud with shining specks, or olive-coloured mud with broken shell. Its eastern edge is rather steep, the soundings eastward of it being from 28 to 30 fathoms.

PILOTS RIDGE LIGHT VESSEL, in about lat. $20^\circ 46' 30''$ N., long. $87^\circ 39' 45''$ E., is placed in position from the 15th March to 31st October, in 21 fathoms, near the eastern edge of the Pilots ridge with the station buoy, which is white, surmounted by a double cone, and marked P. R., bearing North, distant $1\frac{1}{2}$ miles. By day, the light vessel may be recognised by a black ball at the foremast head, and Pilots ridge, painted in white letters on her side. By night, at an elevation of 44 feet, and visible at a distance of 12 miles, is exhibited a *single flashing white* light *every minute*, the duration of each flash being about *ten seconds*, and the eclipse *fifty seconds*. A blue light is burnt every hour between 7 p.m. and 5 a.m.†

Tides.—It is high water, full and change, at the Pilots ridge at about 9h. 50m.; springs rise 9 ft. and neaps 7 ft., neaps range 5 ft. 9 ins. (March to September approximate only).

DIRECTIONS.—Vessels from the southward after making False point lighthouse should bring it to bear about W.S.W., distant 10 miles,

* Cowcolli roads was a general anchorage, and the main ship channel for vessels, as late as 1861–62; but this part appears to be silting up fast, and the channel between Mizan and Auckland sands is constantly altering, and requires careful navigation; strict attention must be paid to the latest charts and reports issued by the River Survey Department.

† At the approaches to the Húgli river, light-vessels out of position at night show a fixed red light at bow and stern, a red flare every quarter of an hour, the station light is put out and if in danger they fire rockets; by day, distinguishing marks are struck and name covered over. All light-vessels during fogs ring a bell at intervals of not more than two minutes. The hulls are painted red, and each light-ship exhibits at night a riding light on the forestay, 6 feet above the rail. The name of the station is painted on the hull in white.

when they will be in 11 or 12 fathoms, and then steer E.N.E. in a gradually increasing depth to 28 fathoms on the eastern edge of the Pilots ridge. The course should then be continued between depths of 20 and 27 fathoms, until the Pilots ridge light vessel is seen, if the time of the year be between the 15th March and 31st October, when a vessel may either heave-to or pursue a similar course, for the Eastern channel light vessel, distant about 34 miles from that of the Pilots ridge.

From the latter end of June to the end of November, there is little or no flood or westerly set off False and Palmyras points except at spring tides, but a strong outset is often found, caused by freshes from the rivers.

South channel buoy, black, with S.C. painted on it, and surmounted with a black basket, is moored in 11 fathoms, in mid-channel, in about lat. $21^{\circ} 0' N.$, long. $87^{\circ} 59' E.$

PILOT BRIGS, Cruising station.—During the south-west monsoon they endeavour to cruise about 4 miles to the south-westward of the Eastern Channel light vessel, the supply brig, as a rule, taking the outer position. During the north-east monsoon they cruise or anchor from 3 to 4 miles to the north-westward of the same light vessel. The brigs are of about 300 tons, painted black, with white stripe, imitation ports, and double topsail yards.

CAUTION.—Vessels approaching the station during the day must show the usual signal for the pilot, and by night fire guns, burn blue lights, and exhibit two lights in a vertical position where best seen; but avoid as much as possible running for the station at night, or in threatening weather; under such circumstances put the vessel under snug canvas while well out in deep water, and keep the sea.

Vessels arriving at the Sandheads and finding the supply pilot brig at anchor, should use caution in closing her on account of the strong tides. When easterly winds prevail, there is a strong set to the westward; it is then specially incumbent on strangers to take advice given from the brig. Vessels coming in at night should never heave-to to windward of the brig if they intend to take a pilot before daylight, but close as soon as possible, approaching round the brigs stern, whether at anchor or under way.

In August, September, and October, when vessels are signalled to keep to windward, they should be careful to keep the light vessel or brigs in sight, for should the wind fall light they are liable to be set out to sea, and, particularly in the two latter months, may not be able to return for many days. The lead should be used frequently. Signals from the brig "to prepare for bad weather," should not be ignored. Study the tide; the first of the flood setting to the Westward, stand to the Eastward; the first of the ebb setting to the Eastward, stand to the Westward

and Northward. A kedge anchor is useful. Strangers anchoring off the light-ship, should endeavour to near the brigs, and not remain at anchor. The practice of rounding the brig close to, in a sea-way, is dangerous, both to the latter and to the boat alongside.

Distinguishing signals used by the pilot brigs.—A red flag at the main informs inward-bound vessels that the brig will supply a pilot, and should be made for without hesitation, irrespective of the other brig. At night, the supply brig attracts the attention of inward-bound vessels by burning maroons at short intervals between the Admiralty 15 minute Regulation.

Should an inward-bound vessel on arrival at the Sandheads find neither of the pilot brigs with the red flag flying at the main, it may be concluded that there are no pilots on the station.

The buoy brig, *i.e.*, the brig that takes out the pilot from outward-bound vessels, hoists a white flag at the fore.

Inward-bound steam vessels should, when within signal distance, indicate gross tonnage to the pilot brig, which cannot supply them with a pilot until this information has been given. Steamers on closing the pilot brig should “lay to” under her stern or weather quarter, and, after the pilot is on board, tow the boat to windward of the brig.

Sailing vessels should invariably “lay to” on the same tack as the pilot brig, unless signalled to the contrary, and should show net tonnage.

EASTERN CHANNEL LIGHT VESSEL, in about lat. $21^{\circ} 0' N.$, long. $88^{\circ} 12\frac{1}{2}' E.$, is at the entrance to Eastern channel in 10 fathoms, with station buoy bearing north, distant one mile, and Lower reef buoy $N. 42^{\circ} W.$, distant 6 miles. Carries a black ball at main, and “Eastern Channel” in white letters on the side. Displays 44 feet above the water a *single flashing white light every thirty seconds*, the duration of each flash being about *five seconds*, and the eclipse about *twenty-five seconds*; and visible in clear weather 12 miles; also carries a riding light on the forestay 6 feet above the rail.

During the south-west monsoon (15th March to 31st October) a blue light is burnt every half hour between 7 p.m. and 5 a.m. In the north-east monsoon, or from 1st November to 14th March, a blue light is burnt every hour between 7 p.m. and 5 a.m. During fogs a bell is rung every 2 minutes.

Tides.—It is high water, full and change, at the Eastern channel light-ship at 9h. 27m.; springs rise 11 ft. and neaps 7 ft. 11 ins. above lowest low water spring tides, of the dry season, neaps range 4 ft. 6 ins.

In the Eastern channel the tides set as follows, when not influenced by the wind; 1st quarter flood, N.W. by W.; 2nd quarter N.N.W.; 3rd quarter N.N.E.; last quarter E.N.E.; 1st quarter ebb, S.E. by E.; 2nd quarter S.S.E.; 3rd quarter S. by W.; last quarter S.W. and W.S.W.

DIRECTIONS for APPROACHING the MOUTH of the RIVER HÚGLI.*—Bound to Calcutta in the south-west monsoon the land should be made on the Orissa coast about Pundi, or between it and Ganjám, where it is high, for in the latter part of March, and early in April, the weather is generally hazy, preventing the land from being discerned, unless very near; a vessel ought not to get to the northward of Jagannáth (Juggernaut) pagoda before closing the coast (*see* page 142).

When to the northward of 18° N. and the vessel's position is not correctly known, haul in and sight the coast. In the night, or in thick weather, the lead, and Purí *fixed white* light which is visible 8 miles will be a good guide, for there is generally from 30 to 35 fathoms about 6 or 9 miles off between Pundi and the *black* pagoda (*see* page 143); about Ganjám the water shoals fast under 20 fathoms towards the shore. When the position is known, steer along the coast keeping in 18 or 20 fathoms in the night, or with unsettled weather; then with daylight and the wind favourable, haul into 14 or 15 fathoms to sight Jagganáth and black pagodas in passing. They will be seen in hazy weather when in 17 or 18 fathoms. With a commanding breeze, the coast may be approached with safety to 12 or 13 fathoms, about 3 or 4 miles from the shore. At night do not come under 15 fathoms nor deepen above 17 or 18 fathoms, for the coast is low, and it will not be seen unless close to. In hazy weather the noise of the surf would probably be the first indication.

When about 10 miles past the black pagoda steer so as to obtain proper soundings off False point (a dark red coloured lighthouse stands S.W. 2 miles from False point and exhibits at 127 feet above the sea an occulting white light, which is visible in clear weather 19 miles). The depths decrease gradually towards the bank surrounding False point, but keep in 14 or 15 fathoms at night when passing it, or in 16 fathoms if the wind is S.E. As the flood inclines towards the shore, and the ebb from it, 14 and 15 fathoms are good depths to preserve with a fair wind when steering from False point.

When False point bears W.N.W. and the vessel in 14 or 15 fathoms, steer N.E. 30 miles to pass outside Palmyras reefs, keeping in 14 or 15

* Abridged from a pamphlet published by the Admiralty in 1857.

fathoms with a commanding breeze, or in 16 fathoms if the wind is S.E. If blowing strong from the S.W. in rounding Palmyras reef in daylight, a vessel may steer along the edge of it in 12 or 14 fathoms, taking care not to approach the north-east part under 12 or 13 fathoms, where it is dangerous and steep-to under 10 or 11 fathoms.

If the coast or the pagodas or Purí light have not been seen, and in steering along in 14 or 15 fathoms, the bottom is sand, shells, and black specks, which are thought to be those off False point, but uncertain whether they may not be those off Palmyras point; then bear in mind that the water will not deepen in steering N.E. from the depth of 15 fathoms off False point, but in steering that course from the depth of 15 fathoms on the edge of the bank off Palmyras reef it will deepen gradually to 17 and 18 fathoms.

The pilot vessels generally cruise about 4 miles south-westward of the Eastern Channel light vessel during the south-west monsoon, or about 30 miles north-east of the Pilots Ridge light vessel, which is in position from 15th March to 31st October.

The above directions are given while the monsoon prevails steady from the S.W. and westward, but towards the close of the monsoon, or in September, this route is likely to cause inconvenience and delay, for the wind then often hangs to the eastward, and the current sets strong to the S.W. During that month, if the latitude can be observed, or the light on False point can be recognized, there is little occasion for making the land so far to the southward.

FIRST OUTER PASSAGE is taken by vessels, if they expect to pass the equator from April to October, with a certainty of gaining their port before the south-west monsoon is over.

On leaving the cape of Good Hope, steer to the southward and run down the easting on the parallel of 38° or 39° S., as far as the meridian of 62° E. From thence steer to the north-eastward so as to enter the southern limit of the south-east trade (between lat. 26° and 28° S.) on the meridian of 80° to 83° E. In continuing the course to the northward care should be taken to gain easting to counteract the effects of the westerly currents, and be prepared for the wind veering to the northward; for in standing across this trade it often happens, particularly in March, April, and May, that it blows more from East and E.N.E. than from S.E. At this period of the year the south-east trade blows as far as the equator, and a vessel, having arrived in lat. 1° or 2° N., may be certain between April and October of the south-west monsoon carrying her to Calcutta, or any part of the bay of Bengal.

If bound to Ceylon, stand to the northward across the south-east trade, and keep a little to the westward of Point de Galle if desirous to make it. If bound to Trincomali or Madras, the land should be made to the southward of the port to provide for the effects of the northerly current which prevails during the south-west monsoon.

SECOND OUTER PASSAGE is taken by vessels bound from the Cape to the bay of Bengal, when it is likely the bay will not be reached before the south-west monsoon is over, or when expecting to pass the equator between October and April, and not to arrive in the bay until the north-east monsoon has set in, or when it is at its greatest force.

From the Cape, run to the eastward as before, between the parallels of 38° and 39° S., and gain sufficient easting to cross the southern limit of the south-east trade (between lat. 26° and 28° S.) on the meridian of 85° E. From thence steer to the northward through the trade, and gradually gain easting sufficient to counteract the effects of the current, and to lie up for Achi head, the north point of Sumatra. A reasonable distance, however, should be kept from Hog island and the north-west coast of Sumatra, for here a vessel may be subject to delay by baffling winds and hard squalls from the N.W., with a current setting into Malacca strait, particularly in October and November, when N.W. and West winds prevail.

After passing about 100 or 150 miles to the westward of the north-west coast of Sumatra, the west side of the Nicobar islands may be approached. If the wind inclines to keep to the westward, give the islands a good berth; if at E.N.E. or N.E. steer up the bay close hauled, to the westward of the islands. On the parallel of 16° or 17° N. the wind often veers to the northward, and favourable tacks may then be made to the eastward, at times, to keep from the western coast of the bay. Neither should the eastern coast be approached, but vessels should work to the northward in the open sea, where there is smooth water and moderate breezes, which will enable them speedily to reach the pilots' station, at the entrance of the Húgli.

It has frequently happened in the strength of the north-east monsoon, that vessels, by passing close along the western coasts of the Nicobar islands, have reached the pilots' station without making a tack. If the equator is crossed late in February or in March, keep well to the westward in passing up the bay, for the current at that time runs to the northward along the Coromandel coast, and the winds will be found between S.W. and S.E.; in the middle of the bay the winds are light and variable from N.W. to N.E. during these months, with a weak current at times setting to the southward.

WEATHER at the Sand-heads commencing from the breaking up of the south-west monsoon, in the month of September, may be expected as follows :—

Month.	Wind.	Force.	Weather.	Remarks.
September	Easterly -	Light and variable.	Showers of rain -	Westerly set depending on force and duration of the easterly winds. Atmosphere generally clear.
October -	Easterly and calms.	Variable -	A stormy month, sultry at times.	Westerly and S.W. set. A gale or cyclone generally expected.
November, December, January.	Northerly in morning and evening.	Fresh in morning and evening, calm midday.	Fine weather with cool morning and evenings.	A cessation of the strong tides of the Húgli. Fogs in January in the morning.
February -	Variable, southerly at night.	Light - -	N. Westers sometimes. Warm towards end of month.	Heavy fogs in morning. Floods strong in Húgli towards latter part of month.
March, April, May.	Unsettled until end of March then westerly, and S.W. in April and May.	Light at first, sometimes strong at end.	N. Westers with rain, thunder and lightning frequent.	Flood tide accompanied by bore at times. Weather hazy, April and May S.W. winds, sometimes a gale or cyclone.
June -	S.W. strong at first.	Strong - -	N. Westers lose their strength. Heavy thunderstorms.	In June the "chota bursat" or small rain commences and generally lasts a fortnight.
July -	S.W. - -	Strong - -	Squally and heavy rains.	Westerly gales frequent. Freshets in the river. Much swell in the Eastern channel.
August -	S.W. and westerly.	Lighter than in July.	Similar to July -	Strong westerly set at Sandheads. Atmosphere generally clear. Wind from westward during day, hauling to southward towards evening.

HÚGLI (Hooghly) RIVER, the most westerly, and for commercial purposes the most important channel by which the Ganges enters the bay of Bengal, takes its name near the town of Santipur about 120 miles from the sea. It is made up by the united streams of the Bhagirathi, Jalangi and part of the Matabhanga. These three western distributaries of the Ganges are known as the Nadiya rivers, and it is owing to the engineering attention paid to their conservancy that Calcutta has not shared the fate of almost every deltaic capital in India, by the silting up of the river upon which its prosperity depends. Much attention has also been paid to the conservancy of the port of Calcutta itself, rendering the Húgli a safe water-way to that port, for vessels of even 26 feet draught.

The chief difficulty to navigation is at the James and Mary sands, 30 miles below Calcutta, which are formed by the entrance into the Húgli on its western side of the Dámodar and Rupnarayan rivers, draining south-western Bengal, and with the Húgli depositing vast quantities of silt

forming banks and quicksands, the ship channels through which have to be watched and sounded daily. The state of the channels is signalled from the bank to each ship on passing. Diamond harbour, below the James and Mary sands, where vessels formerly anchored to discharge cargo and passengers, is now a village, and but seldom used, even the largest vessels proceeding the whole way to Calcutta.*

On the left or eastern bank, the Húgli is connected by various tidal channels and creeks with the network of distributaries by which the Gauges enters the sea; some of these forming waterways for boat and steamer traffic from Calcutta through the Sundarbans to Eastern Bengal and Assam. For practical purposes the sea may be said to commence at about 83 miles from Calcutta, but the Eastern channel light vessel lies about 122 miles, from Calcutta. At the entrance between Saugor island and Khijirí (Kedgerree), about 68 miles from Calcutta, the river is nearly 7 miles in width. From this, for many miles to the southward extend a long line of sands, liable to change, which separate the various channels, and generally take a north and south trend, for the position and peculiarities of which the chart affords a better guide than any written description.

Eastern or Saugor channel,† the main ship entrance, is between Saugor sand on the east and Eastern Sea reef on the west, the distance between them being about 8 miles, and extends from the Eastern channel light vessel to the Lower Gaspar light vessel, or about N. by W. $\frac{1}{2}$ W. for a distance of $25\frac{1}{2}$ miles. The deepest water is found on its eastern side near the edge of Saugor sand, where the bottom is generally a soft but sticky clay, in which the lead sinks deeply.

INTERMEDIATE LIGHT VESSEL‡ placed in position from the 1st February to 30th November (inclusive), is stationed about half way between the Lower Gaspar and Eastern channel light vessels in 42 feet, with the station buoy S. 45° E., distance $1\frac{1}{2}$ miles, Bell buoy N. 43° W., distance 5 miles, and Centre Saugor sand buoy N. $1\frac{1}{4}^{\circ}$ E., distance 4 miles. This vessel carries a black ball at the fore and mizen mastheads and has "Intermediate" painted in white letters on the side. Shows a *fixed white* light 48 feet above the water, visible in clear weather 12 miles; the riding light on the forestay is 6 feet above the rail.

* See Admiralty chart of Húgli river, Calcutta to Saugor point, No. 136; scale, $m=0\cdot9$ inches. The soundings on the Húgli river charts are reduced to the lowest tide of the dry season (December to April). In Calcutta, the Zero is Kidderpur Dock sill, the value of which is 6·25 feet below mean sea-level, and to which all the Port soundings are reduced.

† For the Western channel see Admiralty chart of the Sandheads, No. 814.

‡ In February 1885, a green buoy marked the wreck of the Intermediate light-ship, and a temporary light-vessel was placed one mile south of the position as given above.

LOWER GASPAR LIGHT VESSEL is stationed in the Gaspar channel in 27 feet of water with station buoy S. 46° W., distance $\frac{3}{4}$ mile, Upper Saugor sand buoy S. 58° E., distance $2\frac{1}{2}$ miles, and Lower Western Gaspar buoy N. 44° W., distance $2\frac{1}{4}$ miles. Carries a black cone at mainmast-head, and "Lower Gaspar" in white letters on the side. Displays a *fixed white* light 48 feet above the water, visible in clear weather 12 miles, carries a riding light on the forestay 6 feet above the rail, also burns a blue light at the half hour.

During the time the Intermediate light vessel is not on her station (i.e. from 1st December to 31 January) the Lower Gaspar lightship from sunset to sunrise burns a blue light at the hour in addition to the one burnt at the half hour.

During fogs fires a gun at the hour and half hour.

GASPAR CHANNEL is a continuation of the main ship channel into the Húgli, and extends N.W. $\frac{1}{2}$ N. from the upper part of the Eastern channel to the lower part of Saugor roads, or between the Upper and Lower Gaspar light vessels, for a distance of $5\frac{3}{4}$ miles. The best water through the Gaspar channel, 19 feet, is found by keeping in a line between the Upper and Lower Gaspar light vessels, and after passing the Upper light vessel where there is shoal water for a mile or two, to keep the Lower light vessel on with the Upper light vessel, until Saugor light-house bears N. by E. $\frac{1}{4}$ E.

The sea runs high in the Gaspar channel, so that it is not safe to attempt running through it in the south-west monsoon, until the moon is well above the horizon, or has been set for some time, when the tide will have risen well. The water shoals gradually from 27 feet abreast the Lower Gaspar light vessel to 19 feet in the narrowest part of the channel between the two centre Gaspar buoys; it then deepens a quarter of a fathom, but carries no more than 21 feet, till well past the Upper Gaspar light vessel and well over towards the eastern edge of the Long sand. There is generally too much sea to tack a ship in the south-west monsoon, so that unless the wind allows a vessel to lay through N.W. $\frac{5}{8}$ N., with an allowance for tide, its passage should not be attempted.

Tides.*—It is high water, full and change, at the Lower Gaspar light vessel at 10h. 13m., and during the dry season above lowest low water, springs rise 15 ft. 7 in.; neaps rise 12 ft. and range 6 ft. 5 in. Both flood and ebb stream are inclined to set across the channel especially when the tide grows old, or is in the last quarter of ebb or flood.

UPPER GASPAR LIGHT VESSEL is stationed in the Gaspar channel in 21 feet with the upper Eastern Gaspar buoy on with

* Extraordinary spring tides rise 15 ft. 8 in. and neaps 12 ft. above the lowest tide registered during the dry season.

Saugor lighthouse N. 10° W., distance 2 miles, centre Eastern Gaspar buoy S. 76° E., distance $1\frac{1}{2}$ miles, and upper Western Thornhills buoy W., distance $1\frac{1}{2}$ miles. Carries a black drum at mainmast-head, and "Upper Gaspar" in white letters on the side. Displays a *fixed white* light 24 feet above the water, visible in clear weather 9 miles, also carries a riding light on the forestay 6 feet above the rail. During fogs fires a gun every first and third quarter of the hour.

Tides.—It is high water, full and change, at the Upper Gaspar light-vessel at 10 h. 20 m., and during the dry season above lowest low water springs rise 15 ft. 8 in.; neaps rise 12 ft. 2 ins., and range 6 ft. 7 in.

LONG SAND LIGHT VESSEL, in position from the 1st February to the 30th November (inclusive), is stationed off the Long sand about $3\frac{1}{2}$ miles S.W. by S. of Saugor lighthouse, in 22 feet of water at lowest low-water spring tides, and with the following bearings:—Gaspar light vessels in line S.E. $\frac{1}{2}$ S., Saugor lighthouse N.E. by N., distance $4\frac{3}{10}$ miles, Long sand spit buoy N.W., distance 1 mile.

Carries a small black ball over a larger one, the hull painted red, and "Long Sand" in white letters on her side. Displays a *fixed white* light 21 feet above the water, visible in clear weather 6 miles, and a riding light 6 feet above the rail.

SAUGOR ROADS.—The Gaspar channel northward of the Upper Gaspar light vessel continues a N.N.W. trend between the Long sand to the westward, and Middleton sand to the eastward, for about 8 miles, or until off the south-west point of Saugor island on which is a lighthouse; here the water deepens to 38 and 39 feet, and is known as Saugor roads. Although in ordinary weather there is safe anchorage in Saugor roads, yet in heavy gales a considerable swell rolls in at high water.

Tides.—It is high water full and change, in Saugor roads at 10h. 20m. Springs rise $15\frac{1}{2}$ feet, neaps $12\frac{1}{2}$ feet. At the lower part, or Upper Gaspar light vessel, it is high water a quarter of an hour earlier, with about $1\frac{1}{2}$ feet less rise. The tide runs fair up and down Saugor roads northward of Saugor anchoring buoy; but below or to the southward of that buoy, where the dry portion of the Long sand permits it, the tide has a tendency to flow round the compass, especially the last of the ebb, which sets S.S.W. and S.W.

SAUGOR LIGHTHOUSE, is situated about half a mile N.E. of Middleton point, Saugor island, and exhibits a *fixed* and *flashing white* light illuminating an arc of 225° , viz., from N.W., round by east to south, the interval of revolution or flash being *twenty seconds*; the light is visible in clear weather 15 miles. The lighthouse built of twelve iron cylinders, is painted in alternate red and white horizontal bands; the lantern is a common argand, and stands 74 feet above high water.

Vessels can telegraph from Saugor to Calcutta.

SAUGOR ISLAND, of low alluvial soil, covered with impenetrable jungle except some clearances on its eastern side, is intersected with numerous creeks or khalls, and infested with wild animals. The island is about 40 miles in length, north and south, and from one mile broad at its northern end to 12 miles at its southern. A large creek divides its southern shore into two parts. Saugor lighthouse and telegraph station stand about half a mile inland from the south-west extremity, known as Middleton point. On the eastern side of Saugor island are some large villages, where the land is cleared and cultivated, also Government salt works. No attempt should be made by a shipwrecked crew to cross the island to the lighthouse, but the coastline must be followed round and the creeks crossed in preference. (For position of refuge houses on sea face of Sundarbans, *see* page 181.)

WEATHER SIGNALS.—1. When a severe cyclone (often accompanied by a storm-wave) is approaching the Bengal coast, signals are hoisted at flag-staffs near the lighthouse on Saugor island, at Mud point, and near the telegraph office, Diamond harbour.

Day signal No. 1,
bad weather
signal.

A ball indicates severe cyclone in bay of Bengal, as yet too distant to enable its track to be determined.



Day signal No. 2,
danger signal.

A cone, early probable passage northward and to the eastward of Saugor island and west of Chittagong, of the vortex of severe cyclone. No sailing vessels, nor deep-laden, nor slow steaming steam-vessels should go to sea. The wind at the mouth of the Húgli will probably haul from north-east through north to north-west, &c.



Day signal No. 3,
danger signal.

An inverted cone, early probable passage northward and to the westward of Saugor island and north of False point, of the vortex of severe cyclone. The wind at mouth of Húgli will probably veer from north-east through east to south-east, &c.



Day signal No. 4,
great danger
signal.

A drum, approach of a severe cyclone to mouth of Húgli. Masters and pilots are cautioned not to put to sea from Saugor island, or to proceed down from Diamond harbour, and should make their vessels secure.



2. When a small cyclone (not often accompanied by storm-wave) is advancing towards the coast, one or other of the following signals will be hoisted at the staff near the lighthouse at Saugor island, at Mud point, and near the telegraph office, Diamond Harbour, Calcutta.

Day signal No. 5,
bad weather
signal.

Two cones, the upper one inverted, indicate small cyclone in the bay of Bengal, which will probably reach and cross the coast of the bay south of a line joining Chittagong and False point.



Day signal No. 6.
warning signal.



Two cones, the lower one inverted, indicate existence of small cyclone, which may reach and cross the coast of the bay, north of a line joining Chittagong and False point, but the path of vortex doubtful.

Day signal, No. 7,
warning signal.



A ball below a cone indicates passage northwards and to the eastward of Saugor island and west of Chittagong of small cyclone, of kind which usually forms in rainy season. Vessels may proceed to sea if barometer, state of sea, and weather are such as to lead masters and pilots to infer that there is no danger. The wind at mouth of Húgli will probably haul from north-east through north to north-west, &c.

Day signal No. 8,
warning signal.



A ball below an inverted cone indicates probable passage northward and to the westward of Saugor island and north of False point, of a small cyclone, of kind which usually forms in rainy season. Wind at mouth of Húgli will probably veer from north-east through east to south-east, consequently there will be heavy swell and strong westerly set in the channel at the Sandheads; it is advisable that only fast steamers in light trim should put to sea if weather appearances and state of sea, &c. admit of it.

Day signal No. 9,
danger signal.



A ball below a drum indicates the approach towards Saugor roads of a small cyclone, of kind which forms during the rainy season. Advisable that no vessel other than fast steamers in light trim should put to sea, until the state of weather and sea and rise of barometer indicate that the storm has either broken up or passed inland. Cyclonic storms of small extent sometimes blow fiercely and raise a high sea near their centres.

3. At Night.—The following storm warning signals will be hoisted during the prevalence of cyclonic storms in the bay of Bengal at the signalling stations on Saugor island, Mud point, and Diamond harbour, between sunset and sunrise:—

Night signal No. 1,
warning or
caution signal.



Three lights exhibited on the flagstaff at equal distances, indicate the existence of a cyclonic storm in the north part of the bay of Bengal.

Night signal No. 2,
danger signal.



Two lights in a vertical line indicate the early approach of a cyclonic storm to the Bengal coast.

DIAMOND HARBOUR, off a creek of the same name on the left bank, about 42 miles above Saugor roads, affords anchorage for large

vessels, but is seldom resorted to except by foreign vessels not wishing to ascend to Calcutta. An excellent road exists to Calcutta, and here are a telegraph station and custom house. This is the third reporting station for passing vessels. A dawk boat boards passing vessels, and is generally furnished with the latest weather chart, railway time table, &c. The boat with a blue flag is for outward, and that with a red flag, for inward bound vessels.

Tides.—It is high water, full and change, in Diamond harbour at 11 h. 45 m. Springs rise 16 ft. 6 ins. and neaps 12 ft. 3 ins. above lowest low water of the dry season; neaps range 7 ft. 3 ins. During the summer freshets, the spring tides probably rise 3 to 4 feet higher.

CALCUTTA, situated on the left bank of the Húgli, about 81 miles from its mouth, originally the site of the three riverside hamlets of Sutanati, Kalikata, and Govindpur, is now the capital of India, and the chief centre of communication with all other parts of Hindustán. The population is estimated at about 800,000 people, 7,000 of whom are Europeans, exclusive of the military. The value of the maritime trade fluctuates between 50 and 55 millions sterling. During the cool season Calcutta is the seat of Government in India.

The port of Calcutta extends for nearly 10 miles along the Húgli, and moorings are laid down for about 170 large vessels. The port rules are supplied to vessels on arrival. All necessary supplies can be obtained.

Coal may always be obtained, and is conveyed to ships in steam lighters.

Temperature.—The mean temperature of Calcutta is about 79° F. The highest recorded is 106° in the shade, and the lowest 52°·7. The mean temperature of December and May, the coldest and hottest months are 68°·5 and 85° respectively.

The average annual rainfall is about 66 inches. The highest on record being 93·31 inches and the lowest 43·61 inches. By far the greater part of the rain falls between June and October. The highest death rate is during the cold season, or from November to end of January.

TIME BALL at Fort William semaphore tower is dropped daily at 1h. p.m., Calcutta mean time, equivalent to 19h. 06m. 39·2s. Greenwich mean time. A time ball is simultaneously dropped at the Port Commissioner's office about 1½ miles higher up the river. A flag is hoisted on the semaphore tower at 20 minutes before signal, and ball hoisted at 5 minutes before signal, as preparatory.

Calcutta reach extends from the Royal Mint to Kidderpur docks on the left, and from Howrah docks to Shalimar point on the right bank of the river, on a course of S. by W. ½ W. off the Mint to S.W. by W. ½ W. off Kidderpur, and for a distance of 2·6 miles. The whole breadth of the river from abreast the Mint to the Port Office is navigable. Below the Port Office the channel lies close along the Calcutta bank and contracts in width, from 2½ cables above the Port Office to 1½ cables abreast Fort point; it then widens to 3 cables abreast Kidderpur. There are 30 to 44

feet in the channel above the Port Office, and 45 to 60 feet below it as far as Garden reach.

The tides set fair up and down the reach. The bore breaks on Sumatra sand, running up along the right bank of the river; it disturbs the ships in moorings, as there is a sudden lift of 4 to 6 feet. In the early part of the year, vessels are moored head down the river, and have springs put on their chains.

Húgli bridge, crossing the river above the Howrah railway terminus, about 1,500 feet long, is a wooden structure floating on pontoons of iron, and is opened for the passage of vessels twice a week, as advertised in the daily papers.

Fort point is well marked by a small kiosk with a dome, and has tall bushy trees around it. There are eddies off and below this point on the spring ebbs of the freshets.

Tolly's Nullah is a navigable creek joining the river above Kidderpur. An iron girder bridge crosses it close to the river.

TIDES.*—It is high water, full and change, at Calcutta at 2h. 0m.; springs rise 17 feet; neaps rise 12 feet and range 7 ft. When regular, the flood runs for 5 hours, the ebb for 7 hours. During the north-east monsoon the stream runs 3 to $3\frac{1}{2}$ knots at springs, and $1\frac{1}{2}$ to 2 knots at neaps. Between March and July the flood runs 4 to 6 knots at springs. During the freshets, July to October, the stream of tide sometimes runs 6 knots.

DRY DOCKS AT CALCUTTA.

Name.	Length over all.	Breadth at entrance.	Average Depth.			
			June to October.		October to June.	
			H.W. Springs.	H.W. Neaps.	H.W. Springs.	H.W. Neaps.
† Calcutta -	370 feet	51 feet	$23\frac{1}{2}$ feet	$16\frac{3}{4}$ feet	$19\frac{1}{2}$ feet	$13\frac{1}{2}$ feet
Caledonia -	226 "	$44\frac{1}{2}$ "	$24\frac{1}{2}$ "	$16\frac{1}{2}$ "	20 "	16 "
Commercial -	225 "	$41\frac{1}{2}$ "	18 "	$12\frac{1}{2}$ "	$14\frac{1}{2}$ "	$9\frac{1}{2}$ "
Húgli -	290 "	45 "	$24\frac{1}{2}$ "	16 "	$16\frac{1}{2}$ "	11 "
Howrah, Upper	$326\frac{1}{2}$ "	52 "	$25\frac{1}{2}$ "	$20\frac{1}{2}$ "	$20\frac{1}{2}$ "	$16\frac{1}{2}$ "
" Lower	209 "	$40\frac{1}{2}$ "	$19\frac{1}{2}$ "	$14\frac{1}{2}$ "	14 "	$10\frac{1}{2}$ "
Union, Upper	353 "	76 "	$21\frac{1}{2}$ "	$16\frac{1}{2}$ "	$16\frac{1}{2}$ "	$12\frac{1}{2}$ "
" Lower	368 "	57 "	$22\frac{1}{2}$ "	18 "	$18\frac{1}{2}$ "	14 "
Kidderpur, Upper	211 "	$46\frac{1}{2}$ "	$16\frac{1}{2}$ "	—	$12\frac{1}{2}$ "	—
" Middle	$226\frac{1}{2}$ "	$45\frac{1}{2}$ "	$20\frac{1}{2}$ "	—	$16\frac{1}{2}$ "	—
" Lower	207 "	36 "	$18\frac{1}{2}$ "	—	$14\frac{1}{2}$ "	—

* During the freshets the mean springs rise 21 feet; and the mean neaps rise 16 feet above Kidderpur Dock sill, and during the dry months, viz., between December and June, the average rise of spring tides is 15 feet 2 inches, and neap tides 11 feet 4 inches above the same datum.

† The Calcutta, Caledonia, and Commercial docks can be lengthened respectively 300, 200, and 40 feet.

STORM SIGNALS used within the limits of the port of Calcutta give notice of the early approach of a severe cyclone with its attendant storm-wave. They are hoisted on the flag-staff upon the Port Commissioners' Office, on the yard-arm of Government Dockyard flag-staff, Kidderpur, and on the flag-staff at Sibpur.

A ball (similar to Day Signal No. 1, page 173) indicates a severe cyclone, the centre near Saugor island, and will probably advance towards Calcutta.

A drum (similar to Day Signal No. 4, page 173) indicates a severe cyclone with storm-wave approaching Calcutta.

Three lights in a vertical plane (similar to Night Signal No. 1, page 174) indicate a severe cyclone, the centre near Saugor island, and will probably advance towards Calcutta.

Two lights in a vertical line (similar to Night Signal No. 2, page 174) indicate early approach of a severe cyclonic storm and its storm-wave to the port of Calcutta.

Navigation.—Vessels going against the tide are to ease down or stop if likely to meet other vessels in dangerous parts of the river, such as on the James and Mary's bar, or off Falta point in strong tides, or on the bars when there is only water enough in one or two tracks for the safe passage of vessels. The anchor light is always to be shown at the starboard fore-yard arm when at anchor for the night. The Board of Trade rules of the road are adhered to for the navigation of the channels of the river and estuary. A prolonged blast of the steam whistle, followed by three short ones quickly, is an optional signal that a steamer has been obliged to stop, and cannot get out of the way.

DIRECTIONS.*—Proceeding down river after leaving Fort point steer in mid-river, a course at first about S.W., gradually altering round the bight off Kidderpur docks, and pass round the edge of College sand outside the buoys. When off Camperbaches point you have a fair run of 3 miles W. by N., passing the Botanical Gardens and Garden House point on the starboard, and Mutiabruj Ghat on the port side. After passing Gladstone Wyllie's yard and mills on the port hand, the course should be gradually more to the northward, so as to be well in with the right bank, after passing the red nun buoy marking the flat below the northern port boundary-pillar. As you near Sangral bazar, keep well in to the right bank; and as you haul round Sangral bight or reach, with starboard helm, pass the black buoy marking Sangral sand to port. Hangman's point will be some distance off on the port hand; and if past half ebb, Sangral sand will be showing above water, between you and the left bank, where are several

* Abridged from "The River Hooghly, Calcutta, to Saugor Island," by S. R. Elson, licensed master pilot, Bengal Pilot Service, published by order of the Government of Bengal, 1884.

mills with tall chimneys. Hugging the right bank within 60 or 80 yards, continue under starboard helm as far as Munikholi point, when, on a course of about S.E. by S., cross over towards Babu's house on the left bank, keeping Sangral bazar open, so as to clear the head of Munikholi sand; then, on account of the flat running up along the bank above this mark, edge away with port helm towards Jarmaker's mark below this house, before closing in with the left bank.

On passing over from Munikholi point (if on an ebb-tide more especially) be prepared for eddies, which in the freshets often give vessels much trouble before getting through them.

Opposite Jarmaker's mark the course will be about S.W. by S. or S.W., altering quickly round to West; remember that Munikholi sand comes close in, on the starboard side of the course down; but its edge is marked by a red nun buoy defining the limits of the channel. Continuing on a west course, the white shrine of Pir Serang on the right bank becomes visible among trees on the starboard bow. Passing Koffrí point on your port side cross over to the right bank, gradually opening out the Fort Gloster and Bowriah mills on the right bank; then, over the trees in the distance, Moyapur tidal semaphore can be made out, showing on its elevated mast the height of water at that bar. Keep 80 yards off the right bank, and steer S.W., passing outside Dinghy Wallah's flat black buoy, and passing Empress mills on the left bank. On approaching the upper mills (Fort Gloster), haul out into mid-river, and continue so to Budge-Budge mills and the creek below it, where the channel again hugs the left bank. The course varies from S.W. at the upper part, to W. by N. off Pujalí, passing round the edge of Budge-Budge sand in a channel only 300 yards broad. When off Pujalí, sight a prominent palm tree close to the water's edge on the right bank, which steer for, keeping the left bank in Budge-Budge reach well open, until within 60 yards of the right bank, when haul round with starboard helm, passing Sisbaria creek on a S.W. course, from which place Moyapur tidal semaphore will be in sight again to show the depth of water. Keep close to the right bank, edging gradually round Ulubaria reach under starboard helm. Before passing Sisbaria creek look out for the black board, on which is shown the water in the principal tracks across Moyapur bar.

After passing Ulubaria village on the right bank, the course gradually alters from south to S.S.E. abreast Achipur telegraph station on the left bank. Continue the course still close to the right bank, showing vessel's name for report. Next pass the tidal semaphore and piles on the port hand, and with a telescope read the height of water at the piles. Here pick up the powder boat if required; but it is undesirable to lose headway, as vessels should be well under command when crossing the bar just below.

Cross over to the left bank in one of the eight tracks over the shoal, and after passing on the left hand the magazine, the plantations of coconut trees, and Vanzan creek, reach Devil's point, with a white cross beacon, off which the water is deep, and from which the channel down river lies close along the left bank, with the steep edge of Royapur sand on the starboard hand narrowing the channel to about 200 yards ; a small red nun buoy marks the head of Royapur sand. After passing Devil's point on a South course, haul round Royapur reach with port helm, passing the red beacon on left bank, and red buoy opposite to it, marking the steep outer edge of Royapur sand ; this is the narrowest part of the reach. In rounding the tail of the sand, remember it is parallel with the bank until abreast of the creek and fishing village half a mile below the red buoy and beacon. The channel then widens out to 450 yards, and the sand is less steep-to, but the channel still hugs the left bank until past Sister Trees mark.

Pass the white cross mark of Sister trees on a course of S.W. by W., and, selecting one of the three tracks across Royapur bar, leave the left bank, and cross diagonally to the other side, keeping close to the right bank when abreast the crossing tree at No. 3 track, the course here being S.W. Pass round Hog river reach under starboard helm close inshore until off Pukuria point, known by a plantation of cocoanut trees, the course being then S.E. ; then haul out into the middle of the river, passing the Public Works Department bungalow and Fisherman's point on the port side, on a S. by E. course, then gradually close the left bank of the river, taking up the tracks for Falta reach. In steering down Falta reach pass *Queen Anne* wreck (the lead will be a guide) on the starboard side. After passing Upper Falta mark, Falta flat buoy and index piles on your port side, gradually draw towards the left bank ; below Falta flat and creek the channel lies close in on the left shore, on a course of South opposite the fort, thence gradually steering round Falta sand under port helm until off Falta point when the ship will be heading S.W. by S. After passing this point keep in the centre of Ninan reach, under starboard helm. On your starboard hand you will have passed first the small nun buoy below Falta creek and the larger one off the point. As the channel below the black (F.F. buoy) at Falta village is very narrow, and the edge of Falta sand steep to, great care is necessary when porting the helm to pass a vessel.

After hauling round Falta point with starboard helm, alter course from S.S.W. off the point, to about S.S.E. on adopting one of the three tracks given for Ninan reach, following the selected line till within 50 or 60 yards of the left bank below Anchoring creek. As in Falta reach it must be remembered that the channel is narrow and the edge of Nurpur lumps steep-to. Pass the red buoy, usually placed to mark the western edge of the channel, with Húgli point nearly on with Nurpur point. On nearing

Nurpur point, haul out from the left bank and give the bank below the point a wider berth, heading for Gewankolli until about 100 yards from the bank, and then steer so as to leave the black buoy just above Húgli point, which marks the edge of the flat off the left bank, on the port hand.

Nearing this buoy you will cross successively No. 1 and No. 2 track, and according to the water reports select a track to cross the bar of the eastern gut, passing Húgli point on the port side, Mukruputti buoy on the starboard side, and *Waterloo* wreck buoy on the port side, crossing over straight until near the right bank of the river below the mouth of the Rupnarayan river, in Húgli bight, when alter course, which has been about S.W., and with starboard helm proceed round Húgli bight close to the right bank, on a course of from S.E. to E.N.E. as Luff point is approached, and then continue on the latter course across the river towards Roichuk tree, on the left bank, until the trees at Diamond harbour burial ground are on with Hospital point, when pass the edge of Kukrahatti lumps under port helm, and haul well out into the river off Hospital point.

The course now changes from E.S.E. to about East until abreast the Custom House, after which you round Diamond sand and pass the Custom House, Telegraph Station, Mooring Buoy, and Diamond Harbour creek, with the Magistrate's house and railway-station close below it.

After passing the Custom House, the course changes gradually from East to S.E. off Diamond Harbour creek, and to S. by E. off Kantabaria obelisk. Steer through Kalpi roads on a general South course, until near U.K. buoy, passing first the black buoy on the outer edge of Kantabaria flat on the port side, and the red beacon buoy on the edge of Jigerkolli flat on the starboard side; then haul to about S.W., passing westward of Kalpi anchoring buoy and between the lines of buoys of the channels below Kalpi roads. As these are frequently changed, the latest charts and river surveyors' reports must be consulted for further information.

TIDES.—The level of the water in the river is affected by an annual fluctuation, due to atmospheric conditions between March and September; by the forcing of water into the river by strong southerly winds March to August, and out of it during the northerly winds November to February; and by the fresh water brought down the river from July to October. The difference due to these causes amounts to about 4 feet, the highest level being in August and September, and the lowest in February or March.

The tidal wave (or high water) takes 5 hours 8 minutes to travel to Calcutta from the Eastern Channel lightship, 4 hours 9 minutes from Saugor roads, and 2 hours 4 minutes from Diamond harbour; its rate of progress per hour being 44 miles at Eastern Channel lightship, 17 miles at Diamond harbour, 22 miles at Moyapur, and 18 miles at Fort William.

Above Saugor the velocity of the flood in the dry season, on a perigee spring-tide, is about 4 knots. In the apogee springs its velocity is less. The ebbs of the dry season are not so strong as in the freshets, when for some days at neaps there is no flood stream felt above Diamond harbour, although there is the usual rise and fall. In the dry season there is a slight tidal rise as far above Calcutta as Nadiya, 78 miles.

Bore.—At perigee springs, especially in the months of February, March, and April, bores occur, of more or less violence, according as the tidal data are favourable or not. The first appearance of the bore is on the Diamond sand, where the ascending wave runs on as a breaking roller; but is not of much consequence until it enters the contracted reaches above James and Mary shoals, or Húgli point, when, besides swamping boats, it affects vessels at anchor, by causing them to run up-stream, more especially if there be a strong southerly breeze. The vessels at moorings surge, roll, and sway backwards during the passage of the bore; and when bores are expected, vessels have to put springs on their flood moorings close down to the buoys, the weight of the vessel being held by them instead of by the cable moorings. The noise of the natives along the river bank, signalling to each other, generally outruns the bore. The bore-wave sometimes completely overturns a Calcutta dinghy.

During the freshets anchors are speedily buried up by the silt, so that sometimes it is necessary to slip the cable and leave the picking up of the anchor to the hoy, owned by the Port Trust of Calcutta.

THE SUNDARBANS * form the southern portion of the delta of the Ganges, and extend along the sea face of the north part of the bay of Bengal from the estuary of the Húgli to that of the Meghna, or from about long. $88^{\circ} 4'$ to long. $91^{\circ} 14' E.$ † Their extreme length along the coast is

* Said to take their name from the Sundri tree, which yields a hard wood used for building boats and furniture, and is common throughout the forests of the Sundarbans.

† Houses of refuge for castaways wrecked on the sea face of the Sundarbans have been erected.

No.	Situation.	Peculiarity.
1	On Seyer point, $6\frac{1}{2}$ miles eastward of Saugor lighthouse.	On grassy plain east of some high sand hills. Painted red.
2	On east side of, and three miles within the entrance to Sattarmukhi river and 10 miles east of House No. 1.	In thick jungle, 200 yards above high-water mark. Painted white.
3	On west side of Balchari island and east side of Jamira river.	Distant 200 yards from high-water mark. Painted black.

about 165 miles, and their greatest breadth from north to south about 81 miles. The west and east portions of the Sundarbans lie high when compared with the central part, towards which the ground gradually slopes, and which is low and swampy. In the western part, the water of the streams is for the most part salt, and the cultivated lands are surrounded by high embankments with scattered clusters of huts. In the central part there are no habitations, the water is not salt, and the embankments, which surround the fields on or near which the cultivators do not live, are lower. In the eastern part, the land being high, and the river water almost fresh, embankments are not necessary; the soil too is richer, and the peasant generally has his granaries surrounded by a grove of trees.

The inlying tracts are to a great extent protected from the effects of storm waves by the belt of thick jungle near the sea. Wild animals are numerous, and snakes as well as many description of birds, abound.

The chief place amongst the Sundarbans is Khulna in Jessor, about 65 miles eastward of Calcutta, at the junction of the Atharabanka and Bhairab rivers, towards which boats can be tracked through the Calcutta canals. From Khulna routes branch off north, east, and south.

No.	Situation.	Peculiarity.
4	On S.E. side of Dalhousie island and 4 miles east of entrance to Matlá river.	On a sandy patch. Painted white. Close to is a spar and bamboo with white flag, visible above the trees.
5	On S.E. end of Bangaduni island, west side of Guasuba river, and 7 miles eastward of House No. 4.	Above a small sand beach, and 100 feet from high-water mark. Painted white. Near it is a white spar and bamboo with white flag.

Provisions, water, and stores are placed in each refuge house. The stores are sometimes robbed, so take enough provision if moving from one refuge house to another. No one should stray, tigers are numerous. Make a fire with drift wood. After gales a steamer visits the refuge houses. Unless you have boats await her arrival. In ordinary weather send notice to Mud point, Saugor island, or port Canning or to vessels entering, by boat or catamaran provided. Chart indicates route. Follow the large creeks or sea-beach from one house to another until you come to Channel creek (if going west); there are villages on Saugor island, visible from refuge house No. 1. To the east, villages will be found above the Kattali, on the river Matlá, if proceeding to Canning Town.

Break branches of trees (*allowing them to hang*), if travelling north, on the north side of the trees; if west, on the west side. Do this at points and creek entrances. Carry fire; make signal-fires at stopping-places. The rope is for making a raft or for tracking. Drift wood is often found sufficient for a raft. The hearts of young palm trees are edible; scurvy grass also when cooked. Water can be procured at No. 1 house by digging on the higher part of the land, and in many parts at short distances from the sea, on the higher lands. The hose is to assist to save water when it rains, and to refill tank before leaving the house.

In 1876-77 the timber and firewood imported into Calcutta from the Sundarbans was valued at 590,000*l*. Other products are canes, reeds, honey, beeswax, and shell lime. Large quantities of fish are caught and sent to Calcutta.

THE COAST eastward of Saugor island continues in a series of low, alluvial, jungle grown islands, having sands projecting from them to the southward or seaward, intersected by numerous creeks and rivers, for details of which the chart is the best guide.

Lacam channel, leading to Channel creek, called by the natives Barratulla, which runs up eastward of Saugor island, indicates the opening or entrance to the Húgli between Saugor and Sattarmukhi sands. Lacam channel appears subdivided by a detached bank of $1\frac{1}{2}$ fathoms on its western side, and by a spit extending southward from the west side of Sattarmukhi sand, admitting however a channel about 2 miles in width and safe passage into Channel creek, when aided by local knowledge.

Sattarmukhi river, the entrance to which is between a sand of the same name and another termed Balchari, splits into two branches abreast Balchari island, the eastern of which is termed the Jamira river. Neither are visited by sea-going vessels.

MATLÁ or MUTLAH RIVER*(Raimatla), is the name given to the united streams of the Bidyadhari, Karatoya, and Atharabanka which flow southward through the Sundarbans into the bay of Bengal. The mouth of the Matlá, about 27 miles east of Saugor island, is separated from the Jamira river by Balchari island and flats. A light vessel indicates the position of the approach to the river, the southern extremity of the land on the eastern side of the entrance, being in about lat. $21^{\circ} 32' N$. The Matlá has several branches at its mouth, one of which extends to the salt water lake near Calcutta. The greater number of the buoys placed in 1857 to mark the channel were removed some years back, and sea-going vessels seldom enter the river.

MATLÁ or MUTLAH LIGHT VESSEL off the entrance to the Matlá river, affords an excellent mark for vessels approaching the Húgli from the south-east. The light vessel is moored in $11\frac{1}{2}$ fathoms at low water, mud, about 30 miles from the nearest land and with the station buoy bearing North, distant one mile; or in about lat. $21^{\circ} 2' N$, long. $88^{\circ} 47' E$. A black ball is carried on each of the fore and main mast heads, and "Mutlah" is painted in white on the vessel's side. At night, at a height of 44 feet above the water, is shown a *double flashing white* light, in periods of *thirty seconds*; the duration of each flash being *about two*

* See Admiralty chart of Matlá river No. 82; scale, $m = 1.3$ inches.

and a half seconds ; of the intermediate eclipse, *about two and a half seconds* ; and of the long eclipse, *about twenty-two and a half seconds*, visible in clear weather 12 miles. A rocket is fired at 8h. p.m., midnight, and 4h. a.m. An ordinary riding light is carried on the forestay 6 feet above the vessel's rail.

PORT CANNING, about 60 miles from the mouth of the Matlá formerly a municipality, was started by an English company to supply an auxiliary harbour to Calcutta, with which town it is connected by rail. The attempt failed, and trade has clung to the Húgli.

Canning Town in 1884 was in a dilapidated condition ; the brick buildings exclusive of railway station, cutchery, and rice mills had gone to ruin. The bazár was neglected, and no water fit to drink was obtainable, the large tanks being impregnated with salt. There were about 700 huts.* The foreshore from Canning station to the rice mills, in the Bidyadhari river, was washing away. A tramway which encircles the locality of the intended town was out of repair. The five jetties were worn-out, the boat dock overgrown with scrub, the dock gates and walls having fallen into the river. To the eastward of the entrance to the boat dock a large well-built sluice was in fair repair. A train runs daily to Canning and back from Sialdah station. The rice mills were working. Between Canning and Edu reach there are native villages sprinkled about the clearance. The land below Edu reach to the sea, is dense jungle, with undulations at intervals, as if parts had sunk. At high-water spring tides, below the Kattali, the water runs some distance inland. The country is infested with tiger, pig, and deer.

Western or Ward Channel.—In the lower part of the channel, from the Matlá light-ship to about lat. $21^{\circ} 20' N.$, the soundings shoal quickly from 11 to a flat of about 5 fathoms. This flat extends to abreast the narrow part of the channel between the shoalest part of the Ráimatlá and Balchari sands. You then carry 25 feet, deepening quickly to the northward, and when clear of the apex of Raimatla shoal there is a channel of deep water.

Eastern Channel.—About $5\frac{1}{2}$ miles south-west of Dalhousie point, a shoal has formed with 9 feet on it at low water, which contracts the deep channel in that locality to a mile. The Raimatla sand has changed in shape. The head of the sand is now abrupt, with 18 feet at the apex, which is 6 miles south of Dalhousie point, and to the northward of this the water deepens to over 30 feet. There are heavy rollers over this shoal.

* Abridged from a report by Nav. Lient. E. W. Petley, R.N., Dep. Conservator of the Húgli river approaches, who re-surveyed the Matlá river in 1884.

Dalhousie flat, formed a little above Dalhousie point, extends one mile westward into the channel, and due south $2\frac{3}{4}$ miles; then a small channel exists of 22 to 23 feet; after which comes the 9-foot patch already referred to. From Dalhousie point to the entrance of Kattali reach, the depth of water was greater, although the positions of the several shoals had altered in 1883.

The Kattali.—Diamond sand has a large patch of sand 2 to 3 feet dry at low water. The south channel has a bar extending from Rodger point connecting with Diamond sand. There are two small patches of 15 and 17 feet in the channel, but otherwise it is deeper than in 1853, and in the narrowest part about 200 feet wider.

DIRECTIONS.*—Vessels resorting to the Matlá river during the south-west monsoon should adopt a similar route, and conform to the directions, for making the pilot station at the entrance to the Húgli, taking their departure from the Matlá light-vessel, steering about N.N.W. to feel the tail of Balchari sand in $4\frac{1}{2}$ to 5 fathoms.

During the north-east monsoon, if confident of the correctness of the reckoning, work up direct for the Matlá light-vessel. The bottom throughout the channels is mud, the sands exceedingly hard. The least water in Western or Ward channel is about 4 fathoms. From Halliday island the course continues North up to the “Kattali,” where the river takes a sharp turn to the westward and the channel contracts.

* The entrance of the Matlá river is not so difficult as the Húgli. The Raimatla is a narrow bank, the northern part nearly drying extending N.W. by W. and S.E. by S. for 12 miles, and situated between the Balchari and Bangaduni sands. From the north extreme, West spit, marked in 1885 by two weather-worn buoys, extends 4 or 5 miles S. by W. with depths of from 14 to 22 feet. Ward channel passes between West spit and Balchari sand, and is preferable to the eastern channel. The eastern edge of Balchari sand may be followed up with the lead until Dalhousie point can be recognised at a distance of about 10 miles from a height of 24 feet. The western clump of trees on Dalhousie point appears double and larger than the rest; when this bears N. by W. $\frac{3}{4}$ W. steer for it, allowing for tide, so as to edge off Balchari sand, which gets steep-to and shoal, and keep in mid-channel. Halliday island will now soon be sighted, and the eastern extreme should be steered for. On nearing Dalhousie point it shows a high white sandy beach, conspicuous when the sun is out. No. 4 Refuge house is visible from W.S.W. with a pole and cage over it, but shuts in from further north.—(Commander A. Carpenter, R.N., 1885.)

The chief drawback to the navigation of the river is that between Dalhousie point and the Matlá light-vessel, the soundings are so regular that the lead is no guide in bad or thick weather as to which side of the channel you are on. The edges of the sands are so steep as to render borrowing on them dangerous. Inside the river the same thing occurs.—(Nav. Lieut. E. W. Petley, R.N., 1884.)

TIDES.—Abstract of Matlá (Mutlah) river tidal observations :—

STATIONS.	High-water Full and Change.	Above Lowest Low-water of Dry Season.		Neaps Range.
		Springs Rise.	Neaps Rise.	
Matlá light-vessel	- IX. 43	ft. in. 9 4	ft. in. 6 8	ft. in. 3 4
Halliday island	- X. 12	10 0	7 6	5 0
Kattali (Bidda point)	- X. 45	14 8	12 0	7 0
Port Canning	- XII. 5	17 3	13 2	8 0

The tides below Dalhousie appear to rotate in the same way as they do near the Húgli, viz., the first of the flood to W.N.W., working round to E.N.E.; the first of the ebb commencing at E.S.E. working round to W.S.W., and the strength of the tides is similar to those of the Húgli. The flood runs direct up channel, tending towards the eastern shore until abreast Dalhousie river, when it crosses south of Grappler shoal towards Peel point, forming eddies; it then runs up abreast of Rodger point, where it bifurcates, the greater portion running up Bidda river, and the rest round Rodger point into Kattali bight, leaving slack water in the vicinity of Bidda point.

The strength of the flood tide varies in different parts of the river, but the maximum rate recorded was 5 knots an hour.

The ebb tide inside the Matlá river, sets fairly down the channels until off Rodger point, where it forms considerable eddies; it then runs along Peel island, and down the channel until last quarter ebb, when the direction of the tide is S.W. from about abreast of Dalhousie point, across the river towards Halliday island. The maximum strength of ebb tide recorded was from one to $2\frac{1}{2}$ knots per hour. The maximum rise of tide at port Canning was 18 feet 4 inches.

Bangaduni River, about 5 miles eastward of the Matlá river, is small with tolerably deep water at its mouth, through which the course to seaward is about S.E. It takes its name from Bangaduni island, which forms its east side of entrance, and northward of which is a narrow channel carrying from $2\frac{3}{4}$ to 8 fathoms.

Guasuba River, about 5 miles eastward of Bangaduni river, is of considerable size, but difficult to enter on account of the bending channel at its mouth, which is probably subject to change.

Raimangal River, about 12 miles eastward of Guasuba river, receives, about 6 miles from the sea, the streams of the Hariabhanga on its western side, and the Jamuna on its eastern. This is one of the most considerable openings on the coast, and the channel leading to it appears to have $3\frac{1}{2}$ fathoms in its outer or southern part, in about lat. $21^{\circ} 23' N.$, long. $89^{\circ} 15' E.$, between the entrance banks, but without local knowledge it should be avoided, unless in case of necessity, when the chart will be found the best guide.

Malancha River has its entrance about 7 miles eastward of Raimangal river. The channel leading into it from the southward has depths of 3 to 4 fathoms, is narrow, and takes the direction of about north and south.

Bara Panga River has its entrance about 5 miles eastward of Malancha river, divided from it by Putni island, from which island flats extend to the south and south-east for about 11 miles.

Marjata or Kaga River entrance is about 9 miles eastward of Putni island, and appears curved and complicated, with a depth at low water of about $3\frac{1}{4}$ fathoms. About 5 miles inside or northward of the river entrance, are two low islets termed Pavanga, on the southern of which there was formerly said to have been a tank of fresh water.

At about 20 miles south of the entrance to the Marjata river is the north end of the depression, known as the Swatch of No Ground.

Bangara River entrance is about 13 miles eastward of that of Marjata. The Bangara, which is small, takes a south-easterly course near its mouth, which is separated from that of Marjata by another small river. All three rivers communicate with each other.

Argo flat is the name given to the extensive shoal ground which extends off the mouths of Bangara and Haringhata rivers, and stretches to the south or seaward for about 15 miles. The Argo flat shows dry sand banks in parts, and heavy breakers have been observed on it as far as 8 miles S. by E. of Tiger point, on the west side of entrance to Haringhata river.

Swatch of No Ground* is a remarkable depression in the coast bank of soundings, from 6 to 12 miles in breadth. The north part is in about lat. $21^{\circ} 24' N.$, long. $89^{\circ} 34' E.$ From the depth of 20 fathoms near the north limit, it suddenly drops to 125 fathoms, and at about 30 miles S.S.W. of this, no bottom can be found with 300 fathoms. Nothing is known of the southern depth or limit.

"This remarkable chasm is probably the original bed of the sea. The Húgli was formerly the debouchure of the Ganges, and the annual deposits of alluvium between Pilot's ridge and the Matlá river were then

* See Admiralty chart, No. 859, Matlá river to Elephant point.

great. Now that bank of soundings remains normal, whilst that which extends westward of the coast between Chittagong and Akyab decreases in depth. Within the historic period, the Ganges joined issue with the Brahmaputra, and since that time the combined streams have thrown out the soil which composes the Meghna flats, forming, with the aid of the westerly sea currents between June and December, the natural slope which constitutes the eastern bank of the Swatch.”*

HARINGHÁTA RIVER, signifying “Deer ford,” 70 miles east of the Matlá river, is a deep estuary about 7 miles broad at its mouth, by which the southern part of the Baleswar river, one of the principal distributaries of the Ganges, enters the sea. The river is navigable as high as Morrellganj by seagoing ships, and throughout its entire course by the largest native boats. Navigation is said to be easier than that of any other river at the head of the bay of Bengal, nor is the river disturbed by the bore, which visits the Húgli and Meghna. It is also free from mid-channel dangers. The bar which stretches across the mouth of the Haringhátá has over it 15 feet at low water. The river and its tributaries pass through a tract of fertile country. Vessels that formerly frequented the river did so during the north-east monsoon. A heavy sea prevails at the entrance during the south-west monsoon, and it cannot at that time be recommended—in any case a pilot is necessary.

Morellganj, about 35 miles up the Haringhátá, in lat. $22^{\circ} 27\frac{1}{2}'$ N., converted from jungle into a prosperous rice growing tract by Messrs. Morell and Lightfoot, was declared a port by the government of Bengal in November 1869, and the sands at the approach to the Haringhátá river were buoyed, and beacons placed on each side of the entrance, or at Tiger and Deer points; but all (it is believed) have since disappeared, and the future of the port is now uncertain.†

Tides.—It is high water, full and change, some 35 miles south of the entrance to the Haringhátá river at 10h. Springs rise 9 feet. At Tiger point at 11h. The stream of tide is reported to be strong, at springs, more than 4 knots.

* Commander A. D. Taylor (late I. N.), 1885.

† Sounded the whole of the way down, and found ample water, as well as room, inside the bar. My opinion is that it is eligible for traffic by a draught of 22 feet, during the cold season, with steam to get in; and for small vessels at all seasons with steam to get out during the south-west monsoon. I see no greater difficulty in a small vessel working out in the latter season than a large vessel working out from Saugor. There is no such danger as the *James and Mary*, and the river being comparatively straight, the greatest swerve being from N.N.W. to N.N.E. in a distance of about 5 miles, a handy vessel can work up the whole way to within $2\frac{1}{2}$ or 3 miles of Morrellganj, from which place a vessel can drop or tow.—(Remarks of Thomas McNabb, master of ship *Lady Egidia*, December 1870.)

Rabnabad Island, at the mouth of the channel of the same name, about 18 miles eastward of the Haringhátá river, is about 14 miles in length and $2\frac{1}{2}$ in breadth. The Rabnabad channel westward of it is narrow, with a depth in the northern part at low water of $2\frac{1}{4}$ fathoms. After bending to the south-east round the north point of Rabnabad island, this channel by means of the Kajul and Tetulia river, of which latter little is known, connects with the river Ganges.

Barisál, on the left bank of a river of the same name, connected with the Ganges, is situated in about lat. $22^{\circ} 42' N.$, long. $90^{\circ} 22' E.$, and has a population of about 8,000. The trade, in which the exports greatly exceed the imports, is carried on at river-side markets, regular communication taking place entirely by water. Barisál is the capital of Bakarganj district, the area of which is 4,066 square miles, and population 1,874,201, and which extends to the sea face of the Sundarbans westward of the island of Dakshin Shahbazzpur. The Tetulia river, which appears to afford the nearest route to Barisál from seaward, is from 2 to 3 miles in width, but has not been surveyed.

D'Apres shoal is a sand bank which dries at low water, near the southern termination of one of the banks formed by the deposit brought down by the Meghna. It is situated in about lat. $22^{\circ} 0' N.$, long. $91^{\circ} 7' E.$, or about 18 miles southward of the dry land entrance points of the Shahbazzpur river.

A shoal found in August 1882 by the port officer of Chittagong when visiting the wreck of the *Lady Macbeth* lost on the D'Apres shoal, is reported to exist in about lat. $21^{\circ} 55' 40'' N.$, long. $91^{\circ} 22' 30'' E.$, with a depth of 15 feet at low water. No vessel should shoal under 7 fathoms when passing this vicinity.

GANGES RIVER, the great sacred river of Northern India, formed by the drainage of the southern ranges of the Himalayas, rises in about lat. $30^{\circ} 56' N.$, long. $79^{\circ} 7' E.$, under the name of the Bhagirathi, from an ice cave at the foot of a Himalayan snow-bed, 13,800 feet above the sea. At Allahabad, 668 miles from its source, it receives the Jumna, the combined river winding to the south-east and south until at Goalanda it is joined by the main stream of the Brahmaputra, and enters the sea by the largest and most easterly of its mouths in the Meghna. The most westerly mouth is the Húgli. The length of the Ganges by the Meghna route is 1,557 and by the Húgli route 1,509 miles. Between the Húgli on the west, and the Meghna on the east, lies the delta, which near the sea, intercepted by a network of tidal channels, is known as the Sundarbans.

The most important channel for navigation is the Húgli, on which stands Calcutta about 81 miles from the mouth, and then proceeding from west to east, the Sattarmukhi, Jamira, Matlá, Bangaduni, Guasuba, Raimangal,

Malancha, Bara Panga, Marjata or Kaga, Bangara, Haringhâta or Baleswar, Rabnabad channel, and Meghna river (as approached by the Shahbazpur mouth), and Sandwip channel.

Besides the Húgli,—the Matlá to port Canning, the Haringhâta to Morellganj, and the Meghna to Narainganj, have been ascended by sea-going vessels, but at present (1885) it is believed that there is little or no seagoing traffic except on the Húgli.

The river steam boats, by means of which a great part of the trade carried through the network of waterway of the delta of the Ganges is carried, have recognized routes, which change from time to time, but avoid the open sea. A quantity of cargo is also carried in native boats, which do not always pursue the same route as the steamers. Khulna, about 65 miles east of Calcutta, with which it is connected by canal, is the central mart where all the great boat routes converge. The number of boats registered as passing Khulna in 1877, was 130,313.

BRAHMAPUTRA RIVER,* known to the Assamese as the Haraniya, has an estimated length of about 1,800 miles, the great bulk of its waters flowing to the south-west, and reaching the sea by the broad estuary known as the Meghna. The actual course before reaching British territory has not been satisfactorily determined, but the main stream of the river is made up by the confluence of the Dibang, Dihang, and Brahmaputra proper, in about lat. $27^{\circ} 50' N.$, long. $95^{\circ} 50' E.$

In agricultural and commercial utility the Brahmaputra ranks next after the Ganges and the Indus among the rivers of India, although no large towns are situated on its banks. It is navigable by river steamers as high up as Dibrugarh, about 800 miles from the sea, but the current is so strong in places, that vessels are sometimes unable to make headway and have to stop for days.

Sirajganj in the Bengal district of Pabna is the largest emporium on the banks of the Brahmaputra. Here all the produce of the surrounding country is collected for transmission to Calcutta. The downward trade consists chiefly of tea, timber, oil seeds, caoutchouc, and raw cotton from Assam; and jute, oil seeds, tobacco, rice, and grain from Eastern Bengal.

The imports up stream are European cotton goods, salt, and hardware to Sirajganj; and rice, tea seed, liquors, &c. for Assam. The I.G.S.N. Company run steamers from Calcutta to Dibrugarh all the year through, the time occupied varying from 20 to 25 days. In 1876-77 the value of the tea alone, brought down the Brahmaputra from Assam, was $1\frac{1}{2}$ million sterling.

* The term Brahmaputra (the son of Brahma) is the Hindu name of that section which waters the valley of Assam.

Sandwíp (Sundeeep) Island about 14 miles long, north and south, by 9 miles in width, is the largest of the islands or chars, formed by the Meghna river as it enters the sea. Eastward and northward of it, is the channel by which the Meghna is entered. The island is low and fertile, and said to be free from tigers and other beasts of prey. The principal village is on the eastern side. The cocoa-nut palm flourishes, and sugar cane is cultivated to a great extent. The tide rises 15 to 18 feet. From its low-lying position the island is peculiarly exposed to inundation from storm waves, suffering severely in this respect from the cyclones of May 1864 and October 1876.

MEGHNA RIVER* conveys to the sea the main volume of the waters of both the Ganges and Brahmaputra. It runs south throughout its course, forming a boundary between the two halves of Eastern Bengal, and enters the sea by four principal mouths enclosing the three islands of Dakshin Shahbazpur, Hatiá, and Sandwíp. For some years the Meghna has shown a tendency to shift its channel gradually to the westward. Near Noakhali the mainland is said to have advanced seaward 4 miles in 23 years.

Navigation is practicable as far as Narainganj (about 160 miles), for steam vessels drawing 15 feet, but at the same time dangerous between the months of February and November, when at spring tides a heavy bore is experienced in the lower parts of the river. Sailing vessels will find the passage tedious, although many native brigs drawing 10 to 12 feet, and even Chinese junks make the passage, working almost entirely by the tide.

The eastern or Sandwíp channel leading into the Meghna is that generally recognised as the navigable entrance.† There is a distance of about 70 miles with shoal water and four bars to be crossed.

A steam vessel leaving Sandwíp anchorage with first quarter flood could accomplish the distance in one tide; but the whole distance to Narainganj is 160 miles, and by attention to tide this can be managed in two working days. The worst parts are, (1) the north portion of Sandwíp channel as far as Noakhali point; (2) the crossing at Narnak char as far as the Ilsa river; (3) off the mouth of the Padma river between the chars above Chandpur; (4) the mouth of the Lakhmia river.

Native pilots who are regularly employed in the coasting trade can be obtained at Chittagong. The aid of the local pilots or boatmen is essential in the more difficult parts of this navigation.

* The name Meghna is properly applied only to the channel of the old Brahmaputra, from Bhairab bazar downwards.

† A channel is shown on the Admiralty chart entering the bay of Bengal westward of D'Après shoal, and this seems a better approach to the Meghna, but is not used.

DIRECTIONS.*—The channels and sands frequently change, therefore the following directions must be considered approximate only, and are applicable for the dry season, or November to February. During the rains there is more water, and greater, but more dangerous tidal influence. Vessels proceeding up the Meghna to Narainganj should obtain a pilot at the mouth of Chittagong river, thence steer up along the coast about N.W. by N. for about 25 miles, and if the tide is falling or the day far advanced, anchor in 4 fathoms at low water, with Sitakund hill bearing N.E. by E., north extreme of Sandwip island W.N.W., and the east entrance point of Feni river N. by W. Weighing from this anchorage with first quarter flood the channel used leads about $1\frac{1}{4}$ miles distant from the north-east side of Bidu island, across to the village of Chiringa allowing for a strong set into the Feni river, and close along the south side of a new char formed on the north side of the river, the course steered being about W.N.W.

Bidu bar has about 4 feet at low water, with a rise of from 16 to 18 feet at springs, which run 5 to 6 knots. Native craft only work on the neap tides during the rains, as anchors will not hold in the ebb, at springs.

Sidi bar between the island of Bidu and Chiringa village is the second bar to be crossed in the ascent, and has a depth of about 7 feet with a rise of 14 feet; if there is insufficient flood to carry a vessel across, anchor in about 5 fathoms, abreast the nullah that separates Bidu and Sidi islands. The shoals northward of Sidi undergo frequent changes; it is therefore necessary to obtain the services of local boatmen, and the passage towards Chiringa on the Noakhali shore should be taken towards high water. The banks here on both sides are constantly being cut away by the stream, the loud noise of the mud falling, being heard at short intervals, especially at night. The bank at Chiringa is steep, with deep water close in, and native vessels lie at anchor here in 6 fathoms, out of the strength of the tide. From Chiringa, to Noakhali point, the channel lies close to the north bank of grass land, in a S.W. by W. direction with a breadth of 4 cables at low water.

Noakhali bar.—A single tree stands near Noakhali point, off which is another bar having 12 feet over it, with a rise of tide of 10 feet; here the river turns to the north-west.

Noakhali Point to Narnak Char.—The channel lies close to the east bank with good depth, about 5 cables wide, as far as two palm trees, bearing from the north point of Narnak char N. 72° E., towards which it crosses, with a low water depth of 16 and a rise of about 9 feet at springs. The stream is not so strong here as in the Sandwip channel, and at ebb tide, neaps, the water was fresh. Two new chars, have formed in the lower part of this reach. The east bank is grass-land close to the

* Chiefly from a report by H. B. Simpson, Esq., Marine Survey of India, printed in "Calcutta Government Gazette" of June 20th, 1883.

river, some distance in, clumps of trees grow, and a mosque is visible at intervals; its position being in about lat. $22^{\circ} 46' N.$, long. $91^{\circ} 00' E.$, 2 miles from the bank.

Above Narnak Char (Lallan char) the channel has 20 feet for 9 miles, in a N. by W. $\frac{1}{2}$ W. direction, and lies near the middle of the river towards the west bank; abreast of and beyond Ilsa river, as far as the mouth of Padma river, there is good water, the channel lying close to the west bank. The river trends to the north-west from the mouth of the Ilsa to the Nowa Bhangri, then north to the mouth of the Padma. Beyond Abudu point on the eastern side, a sand extends from the bank to nearly the middle of the river. The west bank is covered with thick jungle from Shahbazpur river to within a mile of the mouth of the Padma.

Off the Padma, the mouth of which is ill-defined, about 18 feet is found. From this, to the first char above Chandpur, there is deep water; running out from these chars are shoals with channels between.

The direction of the river is N.E. by E.; then N. and W.N.W. to Rajbari temple. Above the last char the channel is wide and deep, direction about north, as far as the mouth of Daudkandi river, where it again shoals to 22 feet. After passing the last char above Chandpur, Rajbari temple comes in sight on the west bank; it is situated 4 miles from the river, and is a conspicuous mark. The west bank is almost without jungle from the mouth of the Padma, and numerous villages are seen. The east bank is covered with jungle, from a short distance below Chandpur.

From the mouth of Daudkandi river, the eastern channel is deep as far as the mouth of Lakhmia river, a branch of the Dhaleswari, where there is a bar with about 18 feet and a rise of 2 feet. The western of the two channels formed by a char about 2 miles in extent, has a depth of about 17 feet at the upper bar, which is the shoalest. Above this the Dhaleswari river, by which Narainganj is reached, leaves the Meghna. Off the town of Narainganj, the river is deep on the west side (next the town), with a breadth of $1\frac{1}{2}$ cables.

TIDES.—It is high water, full and change, at the anchorage off Sandwip, at about 2h.; springs rise 18 and neaps 15 feet. Above Sandwip add one hour for every 20 miles as far as Ilsa river. At Narainganj, high water full and change, is at about 11h. 30m., and the rise and fall 2 feet 6 ins.

The Bore* in the outer channels of the Meghna is very strong for four days at spring tides, and its influence is felt to a little beyond the

* At the time of the biennial equinoxes, especially with a south wind, the bore attains its greatest development. The tidal wave is seen advancing like a wall topped with foam nearly 20 feet high, at the rate of 15 miles an hour. In a few minutes all is over and the tide has changed from ebb to flow. In May 1867, Hatiá island was submerged by the storm wave of a cyclone, and in October, 1876, three successive cyclone storm waves inundated Hatiá and Sandwip islands, height of wave being about 40 feet; 40,000 lives were lost.

Ilsa river or about 50 miles below Narainganj. Rushing with violence as a high crested wave, the Sandwíp channel bore meets another passing up between Hatiá and Sandwíp islands, off the north-west end of Sidi, forming a dangerous whirl. Between the months of November and February the bore is lighter and not considered dangerous.

Narainganj on the west bank of the Lakhmia in about lat. $23^{\circ} 37' N.$, long. $90^{\circ} 32' E.$, extends for about 3 miles along the river, and has inland steam communication with Calcutta, with the railway station at Goalanda, the Assam valley, and tea districts of Silhet and Cachar. The steamers tow large flats loaded with cargo especially for Calcutta. Considerable trade by native craft is also carried on with Chittagong. Country produce particularly jute is here collected and transhipped, and piece goods, salt, and European wares distributed. In 1876-77 the value of trade passing through Narainganj amounted to two millions sterling, this figure however sometimes including exports and imports twice over. There are several mills and steam jute presses. The bulk of the trade is in the hands of native merchants. Daily postal communication takes place with Calcutta.

Winds and Weather.—In February the winds were northerly and light, with clear cool weather. Towards the end of the month the sky became more cloudy, and S.E. squalls with thunder and lightning were experienced for some days.

SHAHBAZPUR RIVER leaves the Meghna immediately above Narnak char, and flows between Falcon char, Hatia, and Dakshin Shahbazzpur islands. A bar is found close to the entrance at the north side of Falcon char, with about 14 feet and a rise of 9 feet. Beyond this is deep water as far as Shahbazzpur point, below which is another bar with 14 feet, and a rise of 12 to 14 feet. These two bars are the shoalest parts of the river.

The passage through Hatia island, said to be used by the native brigs, does not seem to be now known by them, and is only used by row boats carrying passengers from the surrounding districts to Chittagong. The river banks in it appear to be very much cut away by the stream, and it probably has a considerable rise and fall, and a good depth at high water.

The land has altered considerably where the Shahbazzpur river leaves the Meghna since 1841, the date of Captain Lloyd's chart, but is much the same as the revenue survey map of 1865.

The approaches to the Meghna by the western or Shahbazzpur river would be out of sight of land for the first 20 or 25 miles, except D'Apres shoal (dry at low water) about 5 miles from its mouth.

Tides.—It is high water, full and change, near the D'Apres shoal, at the entrance of the Shahbazzpur river, at 12h. 30m. Springs rise 9 to 10 feet. Velocity of stream of tide, about 4 knots.

APPROACHING CHITTAGONG.—Whatever the state of the weather or time of the year, but more especially during the south-west monsoon, or from April to September, the greatest care is necessary in making the mouth of the Karnafuli (Chittagong) river. The tides within 15 miles of this part of the bay of Bengal set up and down, or in line with the trend of the land, and at springs run 5 and 6 knots an hour. Vessels have been known, in hazy weather, to have been swept past Chittagong by the flood tide, and set upon the sands westward of Sandwip island, without sighting either Kutabdia island light by night, or the land by day. From 20 to 50 miles from the coast the tides are reported to show a circular tendency, as at the Sandheads of the Húgli river, for the flood tide commences at E.S.E. round by south, ending at W.S.W.; and the ebb, beginning at W.N.W., works round by north, and ends at E.N.E. Endeavour should be made, in nearing the land, if from the southward, to obtain soundings in lat. $21^{\circ} 10' N.$, long. $91^{\circ} 10' E.$ in 10 fathoms, soft mud. Even if the weather be favourable, and a vessel confident as to astronomical position, strict attention to the depth, as well as to the course and distance made over the ground, by making use of the ground log,* will be advisable, and the water never shoaled under 7 fathoms.

The course from the position just given, to the entrance of Chittagong river is N.N.E. $\frac{3}{4}$ E., and the distance 70 miles. If possible the land should be made in the daytime, on account of off-lying dangers, consisting of Dolphin shoal and North and South patches, the vicinity of which is not indicated by the soundings; also on account of Kutabdia light being sometimes shrouded by fog and mist. If in doubt as to position, and the ground log denotes a strong flood tide, it will be well to anchor, to avoid being set to the northward on to the tails of the shoals extending from the south end of Sandwip island and the entrance to the Meghna river, which are said to extend further south than the chart indicates.

During the south-west monsoon, approaching from the south-west, if cloudy weather has prevented observations being obtained, it would be well to sight the white cliffs about Cox Bazar, 48 miles southward of the entrance to Chittagong river, and then keeping westward of Red Crab island, shape course between the North and South patches, and outside the Kutabdia banks keeping the lead constantly going.

KUTABDIA ISLAND, the westernmost land fallen in with when approaching Chittagong, is 12 miles long north and south, by from 4 to 2 miles in width, low and level, covered with trees, and distinguishable

* Similar to the hand log, a lead which reaches the bottom being used, instead of a log-ship. By noting the direction of the line as well as the knots run out, the actual speed and course of the ship *over the ground*, and not through the water only, is thereby ascertained.

at the distance of 7 or 8 miles ; Kutabdia is protected by artificial embankments from the encroachment of the sea.

LIGHT.*—Near the western extreme of Kutabdia island, is a masonry tower, 111 feet in height, from which is exhibited a *fixed white* light at an elevation of 126 feet above high water, visible in clear weather at a distance of 18 miles. The light tower has its lower story coloured grey, and the upper part alternately in red and white horizontal bands.

From the 15th of May to the 15th of September a blue light is burnt from the top of Kutabdia lighthouse, hourly, between 7 p.m. and 5 a.m. inclusive. The glare should be detected at a distance of 20 miles.

SOUTH PATCHES, 13 miles from the nearest land, and 15 miles south-west of the south point of Kutabdia island, consist of three heads of hard sand extending in a north and south direction ; the northern and middle of these heads, having respectively $2\frac{1}{2}$ fathoms and 3 fathoms over them, are connected with one another, and are about $1\frac{3}{4}$ miles apart. The third or southernmost head has over it $4\frac{3}{4}$ fathoms at low water, and is $2\frac{1}{2}$ miles distant from the middle head. In fine weather, rollers may generally be seen near the South patches, and in a fresh breeze the shoaler parts have breakers upon them. Around the South patches, will be found depths of 9 and 10 fathoms, mud.

A whistling buoy, conical, of iron, and painted red, is moored in 10 fathoms at low water, a quarter of a mile due west of the northern head or shoalest part of the South Patches, or in about lat. $21^{\circ} 32' N.$, long. $91^{\circ} 38' 30'' E.$ This buoy can be seen from a height of 20 feet at a distance of 4 miles, and with a moderate sea the sound of the whistle has been reported audible at the same distance. It is liable to be washed away.

NORTH PATCHES cover 12 miles in a north and south direction, extending southward in a broken tongue for that distance from a position about 3 miles westward of the south point of Kutabdia island. The depth of water on North Patches varies from three-quarters to $2\frac{3}{4}$ fathoms, hard sand.

A channel about three-quarters of a mile wide, having from 9 to 16 fathoms of water, runs up inside North Patches, or between these dangers and the sands extending off the south end of Kutabdia and westward from Maskhal island. The tide rushes with great velocity through this channel, and without local knowledge it is better not to attempt it.

* The light apparatus used in Kutabdia lighthouse is an 8-reflector lantern. Light said to be very inefficient, and can seldom be seen more than 12 miles.—Remarks by Com. Stopford, H.M.S. *Arab*, 1st July 1884.

DOLPHIN SHOAL is one of the terminations of the shoal tongue running southward of Sandwíp island. It is about 2 miles long north and south, by half a mile in width, and has over it a depth of three-quarters of a fathom at low water. Between Dolphin shoal and the west side of Kutabdia island, the channel is 3 miles wide, and carries depths of from 6 to 7 fathoms.

A Black Spiral Buoy, with cage, is moored in 5 fathoms at low water off the west side of Dolphin shoal. From it Kutabdia lighthouse bears East, distant 4 miles.

SANGU (SUNGOO) RIVER* the entrance of which, though almost filled up with sand banks at low water, appears, when these banks are covered, to be about 3 miles wide, enters the sea 13 miles northward of Kutabdia island lighthouse, the coast between being low and without distinguishing marks. It is navigable for large cargo boats for 13 miles from its mouth throughout the year, and connects higher up with the Karnafuli, on which Chittagong is situated, by a partly artificial channel.

Norman point.—The north entrance point of Sangu river, is broad and flat, fringed with extensive sand flats, and trending gradually to a bearing of N. by W. and North, forms the eastern bank of entrance to the Karnafuli river. Norman point, about 6 miles northward of the entrance of the Sangu, terminates the sandy sea-face; from Norman point to the northward extensive flats of mud stretch out into the Karnafuli river. Embankments are constructed on the face of Norman point to protect this part from inundation. Numerous small villages dot the coast at about half a mile distant from the embankment alluded to.

A considerable creek, navigable by large boats, enters Karnafuli river close to Norman point; near the mouth is an extensive village, and about half a mile to the eastward a second village, with a large conspicuous tree near its western end.

LIGHTS.—About $1\frac{1}{2}$ miles southward of Norman point, are two *fixed white* lights elevated respectively 37 feet and 32 feet above high water, and bearing from each other N.W. by W. $\frac{1}{2}$ W. and S.E. by E. $\frac{1}{2}$ E., 40 yards apart. The eastern light is shown from a tripod, the western light from a mast. They should be visible at a distance of 7 miles, between the bearings of S.S.E. through east to N. by W. as seen from seaward. These lights can generally be made out before that of Kutabdia island becomes lost to view.

* Strangers are reminded that Karnafuli river entrance may be distinguished from that of Sangu by the flagstaff and semaphore on Júldia hill, the light tripod and mast near Norman point, and the flagstaff on Patunga point, on the north bank of the Karnafuli.

Patunga point is low, flat, and ill-defined, with but few trees. An extensive grassy plain extends some miles inland from its blunted southern point, and a flag-staff, white with basket, situated about the central part of the high-water line, edging the mud flat of the point, affords a good mark. It bears from the highest or easternmost light tripod on Norman point N. 13° W., and from Júldia hill flagstaff S. 84° W.

The coast from Patunga point northward, preserves a low unbroken aspect, trending north and forming the eastern shore of Sandwíp channel. Extensive white sand beach borders the coast, and at about $2\frac{3}{4}$ miles northward of Patunga flagstaff, Maheshkhali creek, which joins Karnafuli river below Chittagong, enters the sea.

KARNAFULI RIVER, the most important river in the Chittagong district, rises in a lofty range of hills to the north-east, and after pursuing a tortuous course, enters the district of Chittagong at the village of Chandraguna.

As far as Kasalang, or a distance of 100 miles from its mouth, the Karnafuli river is navigable throughout the year for boats of 4 tons burden. About 20 miles above Kasalang navigation is stopped by Barkal rapids. Above Barkal, the stream narrows, its course being north for some distance until the Demagiri falls, three days' journey from Barkal, are reached, above which, the river becomes insignificant.

The chief tributaries are the Kasalang, Chingri, Kaptai, and Rankheong rivers, of which the two first are navigable by boats. Below Barkal rapids, the Karnafuli flows in a bed composed of mud and sand, and its banks, covered with jungle, rise to a height of 60 feet. As far as Kasalang, or about 100 miles from its mouth, the tide is felt, and except during the rains, when the current is rapid, its flow is sluggish.

The bar extends across the river's mouth, and for 3 miles in a north-east and south-west direction, or from immediately abreast Júldia Hill and flag-staff inside the river, to $1\frac{1}{4}$ miles westward of Norman point near the entrance. The depths in the best channel (1883) varied from 9 to 17 feet at low water. The shoalest parts are those at the south-west limit, where from 9 to 10 feet will be found at low-water spring tides, immediately between the two outer buoys, and at about 2 miles inside the outer edge of the bar, or south-eastward of Patunga flagstaff, where from 10 to 11 feet must be expected.*

In strong south-west winds a confused and dangerous sea breaks on the outer part of the bar.†

* In October 1885, it was reported that the depth of water on the bar, at low water spring tides, was $11\frac{1}{2}$ feet.

† Reported lumps on the bar appear to be often caused by the grounding of vessels, the bank forming around the vessel, more especially on the up-river side, or that exposed to the ebb stream.

The best time for vessels to cross the bar is at slack water of high tide, and next to this, on the first of the ebb. The tides set across the outer part of the bar, the flood N.N.W., the ebb S.S.E. At springs, the flood tides run strong, and are apt to sweep vessels to the northward and westward of the river entrance.

A draught of 22 to 23 feet by steam-vessels, or vessels towed, in moderate weather during the height of spring tides may cross the bar. The best class of vessels, for the trade of Chittagong, are those between 600 and 700 tons.

Sailing ships are sometimes detained on leaving the river during the south-west monsoon, for want of a favourable wind. This may generally be expected at night in a land breeze from the northward.

Bar buoys.—In 1883, six can buoys surmounted by baskets, marked the channel entrance to the Chittagong river; those on the western side of the channel coloured red, those on the eastern side coloured black.

From the outer red buoy, Patunga flagstaff bears N. 46° W., distant $1\frac{3}{4}$ miles, and from the outer black buoy, the highest or eastern light-house on Norman point bears S. 46° E. distant 1 mile and 7 cables.

The two outer buoys are liable to be washed away as the tide sets fiercely past them, and they are exposed to a chopping sea.

WESTERN ENTRANCE leading marks.—A square pillar coloured white, situated on a hill bearing nearly North, distant $8\frac{1}{4}$ cables from Júldia flagstaff, eastward of, and nearly touching, a white post 50 feet in height, surmounted by a white triangle, on the plain at foot of the hills, bearing N. 40° E., leads over the outer part of the bar in from 9 to 10 feet at low water, and about a cable south-east of the outer red bar buoy, marking the north limit of the channel, until an overhanging tree (Leading tree), northward of the pillar, comes in line with a white triangle surmounted by a white disc on a pole, on the river bank bearing N. 35° E. A vessel will now be about $5\frac{1}{2}$ cables north-eastward from the second red buoy (passed close to), and a N. 35° E. course should be pursued, with the white disc and triangle just alluded to, in line with Leading tree. This leads over the deepest water on the inner part of the bar, and into the deep basin off Júldia village, where quiet anchorage may be found.*

TIDES.—It is high water, full and change, on the outer part of the bar at the entrance to Karnafuli river, at about 0h. 45m. Springs rise 15 to 16 feet, and neaps 10 to 11 feet. During the south-west monsoon, April to October, extraordinary spring tides have been known to rise as much as 19 feet above low water spring tides datum of the dry season (January to April).

* If caught upon the bar and unable to get either out or in, there is anchorage for one ship of 17 feet draught, at low-water, close to the middle red buoy.

Off Júldia flagstaff, upon the inner part of the bar, the flood tide is half an hour later than at the outer part of the bar. Near the town of Chittagong high water occurs about 45 minutes later than at Júldia, and $1\frac{1}{4}$ hours later than at the outer part of the bar. The stream of the tide changes, about $1\frac{1}{4}$ hours after high water, and $1\frac{1}{4}$ hours after low water, off Chittagong, and $1\frac{1}{2}$ hours after the same cessations near Júldia. During the rainy season, April to September, the ebb runs with great strength. Under ordinary conditions, the tidal streams average about 2 knots at neaps, and from 3 to 4 knots at spring tides.

PILOTS.*—Vessels strange to the port of Chittagong, and those of large draught, should take a pilot, anchoring in from 30 to 36 feet outside the bar, with Norman point lighthouse bearing E.N.E., distant about $2\frac{1}{2}$ miles, and Patunga flagstaff N. by W. $\frac{1}{4}$ W., making the requisite signal. There are two pilot cutters of about 30 tons, their distinguishing flag shown at the masthead, having a single white and red horizontal band; one of these will generally be found at anchor about 3 miles south-west of the outer bar buoys. The pilots are well acquainted with the navigation of the river.

Moorings.—There are 16 sets of moorings for first class ships. Of these, 14 are swinging moorings.

Tidal signals are exhibited from the semaphore on Júldia hill to vessels outside the bar, and denote the rise of tide on the bar above the level to which the chart (1883) is reduced.

Júldia hill, about 88 feet high, has upon its summit a prominent flagstaff, a semaphore pole, and bungalow, with a large tree close south of it.

Five-tree hill has the appearance from the river of forming the southern limit of an extensive table land, of which Júldia hill forms a part, and has upon it, five trees, of which the central one is the most prominent.†

* The pilotage rates are as follows: steam vessels are charged a half, and vessels taking steam to tow them, two-thirds pilotage rates:—

DRAUGHT IN FEET.	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23*
In or out	Rs. 30	Rs. 36	Rs. 42	Rs. 50	Rs. 60	Rs. 70	Rs. 80	Rs. 95	Rs. 110	Rs. 125	Rs. 140	Rs. 160	Rs. 180	Rs. 205	Rs. 230	Rs. 260

* For every foot or part above 23 feet an additional sum of Rs. 32 will be charged. Three-fourths rates will be charged for steamers and vessels towed by steam.

† The group of hills forming this apparent table land, are much cut up with numerous projecting spurs, detached paps, and twisting valleys, but in the distance the whole blend together, and assume a flat even-topped appearance.

Solitary tree is round and bushy, and crowns a steep detached hill about the same height as, and situated three cables south-east of, Júldia flagstaff.

Leading tree, on the ridge about a mile north of Júldia flagstaff hill, has a flat umbrella top. Used in conjunction with the triangle and disc on a pole on the river bank on its southern side, as well as with the single triangle on the river bank on its northern side, it is a leading mark for ascending and descending the river.

White pillar, on the highest part of the ridge between Júldia flagstaff hill and leading tree, is 15 feet high, coloured white, surmounted by a lantern elevated about 90 feet above high-water. White pillar seen in line with the south-east corner of the white triangle on an iron pole, on the river bank, bearing N. 40° E., leads over the outer part of the bar in 9 feet.

Tide gauges.—At a distance of 3 cables westward of Norman point is a disused tide-gauge. Off Júldia hill station, on the edge of the mud bank lining the river, is a tide-gauge marked in 3 feet steps, by which the tidal signals governing the entry and exit of vessels, as signalled from the Semaphore, are judged.

Crossing marks.—Two miles northward of Júldia hill flagstaff, on the east or left bank, is a tripod surmounted by a barrel, the whole painted white; and 280 yards N. 15° E. of this tripod, is a second tripod surmounted by a pole, on which is a white cross facing southward, and over the cross a white disc facing westward. The barrel and cross in line lead up in deep water through the Júldia basin, clear of danger.

Flat tree is situated on the northern part of the ridge of hills, of which Júldia hill forms a part. It bears from Júldia flagstaff N. 14° E. distant 2 miles 1 cable. Flat tree, in line with the white disc on the northern of the two tripods previously described on a S. 87° E. bearing, leads in 13 feet at low water over the second bar, which extends eastward across the river from the north-east point of Patunga island.

A pole, used as a crossing mark on the western bank of the river, is situated on the north-east part of Patunga island, and is a rough guide for crossing, when bound up river. It denotes the limit to which vessels of 23 feet draught may be moored in the pool of the river above the second bar.

Second bar extends across the river at the elbow formed by the trend of the reaches of the river around the north-east point of Patunga island, and has over it from 13 to 14 feet.

Crossing mark is the white disc over the cross on the northern tripod on the east bank of the river on with Flat tree on the ridge half a mile to the eastward, bearing S. 87° E.

After the second bar, the navigation in the ascent of the river to abreast the town of Chittagong is easy, until the bar of hard ground, the shoalest part of which, is marked by a buoy (staff and ball) coloured red, black, and white, is reached. This buoy, may be passed on either side in a depth, at low-water, of 13 feet; but threading a vessel's way amongst the shipping, if strange to the place, will prove hazardous.

Inner buoys.—A small black can buoy marks the western edge of a 7 feet patch inside the river off Júldia flagstaff. From it Júldia flagstaff bears N. 63° E. and Patunga flagstaff N. 81° W. This patch may be passed on either side, but if using the Western channel, the west side of it is the side that should be kept.

A black buoy situated off the mud flat on the east or left bank of the river above Júldia flagstaff, is a mark for the western limit of the shore bank, having over it 11 feet at low water. From it Júldia flagstaff bears S. 7° E., and Leading tree N. 69° E. The channel lies on the west side of this buoy.

Two red buoys between Júldia and the second bar, mark the eastern limit of the bank extending into the river from the north-east part of Patunga island. The channel lies between these red buoys and the eastern bank of the river. From the northern, Leading tree bears S. 39° E., distant $5\frac{1}{4}$ cables, and from the southern, the same object bears S. 80° E., distant $3\frac{1}{2}$ cables.*

Six creeks enter the river on the western side between Chittagong and the second bar. The eastern bank becomes low and swampy, and is broken up into four mud-formed islands locally known as chars. There is a passage for boats eastward of these chars at high-water.

Fakír hill, near the western extremity of the Chittagong hills, on the summit of which is a prominent tree, is the only conspicuous mark in the background of the river after the Júldia group of hills is passed. From Sandwíp channel it is reported to be visible at a distance of 15 miles on a clear day.

Five black buoys, mark the western edge of the bank on the east side of the channel above the second bar; the 14 black mooring buoys, may be distinguished from those marking the channel, being much larger.

CHITTAGONG PORT second in importance of the ports of Bengal, affords access to ships of 20 feet, and at spring tides of 24 feet draught. With the improvements in lighting and buoying the approaches to Chittagong, the moorings which have recently been laid down for large vessels, and steam-tug, Chittagong should continue to increase in

* The bank off the north-east part of Patunga island is reported to be extending to the eastward, these buoys are shifted accordingly. October 1885.

prosperity, more so on account of the proximity of the port to the Meghna, tapping as that river does, much of the country traversed by the Ganges and Brahmaputra, and offering a waterway to the numerous native brigs and other craft which carry down from the river port of Narainganj, jute, rice, &c.*

A telegraph wire stretches across the river just above the town of Chittagong at a height of about 50 feet above high water. Small vessels bound up river, above the town, should lower their upper masts in consequence.

Trade.—The trade report of Chittagong for the year 1881–82 showed an increase over that of 1880–81 of upwards of 45 lakhs of rupees, or about 380,000*l*. The value of the trade in the latter year amounting to 1,571,956*l*., and the number of vessels which entered and cleared the port to 96, representing an aggregate of 68,100 tons, or 19,319 tons in excess of the 71 vessels entered and cleared in the year 1880–81.

Exports.—The export of jute is rapidly increasing. Rice, paddy, tea, and cotton are also largely exported.

Imports.—Salt in large quantities from Great Britain, earth oil, and piece goods, and occasionally timber from Rangoon.

Supplies.—Fresh provisions are to be had at Chittagong at moderate prices, but fresh water is not easily procured, the price for delivery alongside amounting to about Rs. 30 per 1,000 gallons. For washing purposes the water brought down by the last of the ebb, about 2 miles above the town, will be found sufficiently cleanly. Coal in quantities up to 100 tons can generally be purchased, at a cost (for Welsh coal) of Rs. 25 per ton.

Communication.—The great trunk road to Dacca, to the northward, runs from Chittagong parallel to, and at about three miles from, the eastern coast line of the Sandwip channel. There is a daily post by land to Calcutta, and facilities for telegraphing throughout India and Europe. Weekly mail steamers run direct to and from Calcutta.

Repairs.—Vessels, up to 1,400 tons, can have their bottoms repaired or cleaned by beaching on a bank of hard sand. Ship-building was formerly carried on to a considerable extent, but of recent years has fallen away. Repairs, however, can still be effected at about the same rates as are charged at Calcutta.

THE TOWN, named by the Moguls in 1665 Islamabad, or the Residence of the Faithful, has an interesting early history attached to it.† It is situated on the western or left bank of the Karnafuli river at about 12 miles from its mouth, and lies scattered with its villages amongst a group

* A variety of quaint looking country brigs, averaging from 50 to 300 tons, ply between Chittagong and Narainganj on the Meghna.

† Stewart's History of Bengal, pp. 187–189.

of small, steep, table-topped hills, the whole covering an area of nine square miles. The European residents inhabit the bungalows built on the summits of these hills. The chief buildings are the Government offices, Roman Catholic cathedral, Protestant church, mosque, school-houses, dispensary, post office, and club house. The merchants' offices and business quarters fringe the river's bank. Near at hand are the offices of the French and United States Consuls, two mills for cleansing rice,* agencies for various shipping companies, port office, custom house, &c. The population amounts to 20,604.

Health.—Although the native town of Chittagong, on account of the numerous disused tanks, is considered unhealthy, the port is not worse in this respect than other river ports of India. Vessels visiting Chittagong are permitted the attendance of a Government surgeon at a moderate charge. The most unhealthy month of the year is September, or towards the close of the rainy season. Fever is then prevalent. In the months of April and May epidemics of small-pox and cholera are most to be expected. An easterly wind, if of long continuance, is said to be unhealthy.

WINDS AND WEATHER.—Chittagong is exposed to the south-west monsoon, and the rainfall is generally heavy, averaging between 105 and 106 inches.† A sea breeze usually prevails during the day rendering the air comparatively cool. The atmosphere is frequently loaded with moisture, causing heavy dew at night and occasionally dense fogs.

The prevailing winds from March to May are from south-west; from June to September from south-east to south-west; and from October to February from north-east. From the middle of October to March, the weather is fine and settled; but towards April the wind becomes more easterly, with occasional heavy north-westerns in the afternoon. From about the end of April the south-west monsoon blows fresh in the upper part of the bay of Bengal; but near the land in the north-east part of the bay, land and sea breezes are met with. Near Chittagong, in the forenoon, the wind generally blows from the south-east and is moderate; towards the afternoon freshening up and veering to the south-west quarter. In June and July, during the height of the south-west monsoon, it blows hard from south-south-east to south-west with rain, leaving now and then a few comparatively fine days.

* Rice at Chittagong in husking is parboiled before shipment. This is said to give it superiority as a grain cargo over rice not similarly treated, which is liable in bulk to accumulate heat, at times to a dangerous extent.

† At the beginning of the present century, Chittagong was considered a sanitarium, and resorted to from Calcutta on account of its cool sea breeze.

The following is a monthly mean meteorological table resulting from observations made at Chittagong :—

Month.	Temperature.	Barometer.	Cloud proportion.	Rainfall.
		ins.		
January - - -	66·8	29·917	0·98	0·56
February - - -	71·5	29·871	1·32	1·26
March - - -	77·9	29·802	2·56	1·31
April - - -	81·8	29·730	3·72	4·70
May - - -	82·9	29·651	4·35	9·18
June - - -	81·9	29·552	9·91	22·46
July - - -	81·0	29·544	7·19	22·27
August - - -	81·0	29·589	6·61	21·43
September - - -	81·4	29·659	5·96	12·93
October - - -	80·2	29·768	3·87	6·32
November - - -	74·4	29·885	1·90	1·81
December - - -	68·3	29·937	1·39	0·41

Cyclones.—Although Chittagong is much exposed, serious injury by cyclones is not often caused. In 1849, and again in 1872, and in 1876, severe cyclones, accompanied by storm-waves, worked great havoc in the district. In 1849, large quantities of slime and salt were left upon the soil, when the sea water had again subsided to its natural level. In 1876, a severe epidemic of cholera occurred immediately after the cyclone, numbers of natives as well as several Europeans falling victims.

THE COAST of Chittagong from the entrance of the Sangu river, described at page 197, trends to the southward for about 9 miles, and is low and without any marked feature, it then recedes and becomes broken up by numerous shallow streams, and continuing its southerly trend for another 15 miles forms the eastern shore of the Kutabdia channel, about 2 miles in breadth, which cuts off Kutabdia island from the mainland. This channel, which from the present chart appears blocked, during the last century, under the name of the Okoia passage, was stated to afford excellent shelter for ships during the south-west monsoon. The entrance appears to be from the southward, or through a deep gut which runs up in a northerly direction between the North patches and the shore of Maskhal island.

For description of Kutabdia island and light see page 196.

Maskhal island.—Mattabari island is the next south of Kutabdia, and forms the eastern shore of the south part of the Kutabdia channel. It is separated from Maskhal island by the Mattabari channel, which is narrow and shallow. The south point of Maskhal island is distant about 15 miles, south of the south point of Kutabdia island. Maskhal island is hilly, the highest hill Garamchori, in the north-east part, being 288 feet in altitude.

Red Crab island is situated 2 miles S. by W. of the south point of Maskhal island; it was formerly an islet of white sand with a few green shrubs on it, lying on the flat, dry at low water, which extends southward of Maskhal island. It is doubtful whether Red Crab island is any longer recognisable.

Maskhal channel divides Maskhal island from the mainland, but its entrance, which is to the southward, is blocked with shoals. The Bagkhali river, empties itself into the south-east part of the Maskhal channel, and on its left bank at a distance of about 2 miles from its entrance is the town of Cox Bazár with a population of about 5,000. Between Red Crab island and the mainland is a narrow channel leading to Cox Bazár, having depths on the bar of from $1\frac{1}{2}$ to 3 fathoms, and from 5 to 8 fathoms inside.

WHITE CLIFFS, visible from 18 to 20 miles, and a good land mark for making the coast during the south-west monsoon or in thick weather, if bound to Chittagong, front the coast from lat. $21^{\circ} 19'$ to lat. $21^{\circ} 24' N.$, at a distance of about 9 miles southward of Maskhal island. With the evening sun, these cliffs are conspicuous from the westward. Inland, at about 12 miles E.S.E. of White cliffs, Sugar loaf mountain rises to a height of 1,358 feet.

In case of necessity only, a vessel with good ground tackle might ride out bad weather near White cliffs in about 5 fathoms, which depth will be found $3\frac{1}{2}$ miles off shore; the bottom is said to be tenacious under a thin covering of soft mud.

Tides.—It is high water, full and change, near White cliffs, at about 11h.; springs rise 9 to 10 feet.

ELEPHANT POINT, also known as Dombak, in lat $21^{\circ} 10' N.$, long. $92^{\circ} 2' 30'' E.$, is 9 miles south of the southern part of the White cliffs, and is surmounted by a hill visible about 12 miles. A reef extends about a mile seaward from Elephant point, which should not be approached nearer than 2 miles, nor in a less depth than 8 fathoms. Northward of Elephant point and between it and White cliffs, at distances respectively from the point, of 3 and 7 miles, are the entrances of creeks. This part of the coast has not been thoroughly surveyed, soundings are scarce in the existing charts, and caution is therefore needed when navigating in the neighbourhood.

CHAPTER VI.

COAST OF ARAKAN AND BURMA—ELEPHANT POINT AND
AKYAB TO CAPE NEGRAIS.

VARIATION 3° *Easterly* in 1887.

THE COAST* from Elephant point trends S.E. for 11 miles to abreast Quoin hill, situated about $1\frac{1}{2}$ miles inland, and thence S.S.E. for 15 miles to a position where a break occurs, separating Shahpuri island from the main land. This part of the coast forms the west side of a hilly peninsula, inside of which the Naaf river runs up to the northward, almost parallel to the trend of the sea shore. Table land or Horse head, 2,100 feet high, in about lat. $21^{\circ} 8' N.$ and 13 miles inland, forms a good landmark when a ship is to the northward of St. Martin reef. There are but few off-shore soundings on the chart of this part of the coast, which has not been thoroughly surveyed.

Shahpuri Island separated from the land forming the Naaf peninsula by a narrow channel, is 5 miles in length, north and south, by about 3 miles in width. This island has foul ground extending along its western coast and to seaward, for a distance of about a mile from the shore. The channel between Shahpuri and St. Martin islands is about 4 miles broad, and carries depths of from 2 to 3 fathoms, but its navigation is intricate and should not be attempted by strangers.

ST. MARTIN ISLAND, $4\frac{3}{4}$ miles in length N.N.W. and S.S.E. by about $1\frac{1}{4}$ miles in breadth, tapers to a point at its southern end, which is well marked by a single tree. It is formed by two or three islets united by ledges of rock; these islets are covered with jungle, having here and there scattered trees, averaging 40 feet in height, and visible 10 miles off. The northern part of the island is highest, and when approached from the southwest, appears as a bluff about 60 feet high. Off the west side of the northern portion of St. Martin island is a low rocky islet, westward of which, the rocks dry at low water for about 2 cables.

* See Admiralty chart No. 821, Elephant point to Chedúba strait.

Shoal water extends off the west side of St. Martin island to the distance of about a mile. The I.G.S. *Hugh Rose* shoaled into 10 feet at half flood, with the north-west tree bluff of the island bearing N. by E., and the south point about S.E. by E. At 2 cables seaward of this position, the depths increased suddenly from 3 to 8 fathoms.

St. Martin reef on which the sea breaks heavily at times, is of small extent, nearly awash, and bears from the south point of St. Martin island W. by N. $\frac{1}{4}$ N. distant $9\frac{1}{4}$ miles. Soundings to the westward or seaward of St. Martin reef have not been obtained and it should be carefully avoided. St. Martin reef is in about lat. $20^{\circ} 35' 30''$ N., long. $92^{\circ} 10' 15''$ E.*

NAAF RIVER† is the boundary between the provinces of Chittagong and Arakan. It is about 3 miles broad at its mouth, and extends parallel to the coast as a considerable stream as far north as Elephant point, receiving many tributaries. Depths of 7 and 8 fathoms are shown inside the shallow bars of this river, as far as the north-east point of Shahpuri island, beyond which no survey is extant. The outer bar is dangerous for shipping, as on the flood tide, which is the safest time to pass, the surf and swell run high in 3 fathoms of water, and the bottom is hard. No directions for entering can at present be given.

Tek Naaf is a small town and telegraph station situated about 12 miles northward of the entrance of the Naaf river, near the right bank or Chittagong side. Ferry boats ply between this place and Maungdaw, the principal town of the district, on the opposite or Arakan side of the river. Native craft trading to Tek Naaf enter the river by crossing the bar between Cypress point and Shahpuri and St. Martin island, the depth is said to be about 10 feet and the bar a shifting one.

Tides.—It is high water, full and change, at the entrance of the Naaf river at 10h. Springs rise 8 to 11 feet.

THE COAST from Cypress point, which is the point on the eastern side of the entrance to the Naaf river, trends about S.E. for $12\frac{1}{2}$ miles, forming a bight, to a well-marked point rising to a black hummock, close to the northward of which is a rock awash; there are extensive reefs with breakers about midway between the black hummock and the south point of St. Martin island. The coast then continues on about the same bearing for $2\frac{1}{2}$ miles, where the Amdang, a small stream, enters the sea, and again continues a S.E. and S.E. by S. trend to the western entrance point of the

* As determined by Captain James, of the B. I. S. N. Company. This position is S.S.W. $\frac{3}{4}$ W., $1\frac{1}{2}$ miles from that which it formerly occupied on the chart.

† See plan of entrance to Naaf river, on Admiralty chart, No. 821 scale, $m = 0.5$ inch.

Mayu river. High land runs parallel with this part of the coast, the southern peaks, of which (that in lat. $20^{\circ} 22' N.$ is perhaps the most conspicuous), are from 600 to 700 feet high. Abreast and northward of St. Martin island, the hills become higher and more marked. High peak about 7 miles north-east of Maungdaw is 1,886 feet in height; northward of this is a low gap, and then two or three remarkable mountain tops. About 3 miles distant from this part of the coast, a depth of 6 fathoms will be met with; inside that distance, no soundings have been obtained, but for the whole distance between Cypress point and the western entrance point to the Mayu river, the coast is said to be fringed by a shoal bank having 3 or 4 fathoms on its outer edge, 2 or 3 miles off shore.

Asirgarh shoal distant about 9 miles S.E. $\frac{3}{4}$ E. of the south point of St. Martin island, and $5\frac{1}{2}$ miles from the shore, has over it a depth of 9 feet at low water, with $4\frac{1}{2}$ fathoms half a mile to the southward, and is considered dangerous. There are depths of 6 and 7 fathoms between Asirgarh reef and the shore.

OYSTER ISLAND, so-named by Captain Ritchie, in 1770, from the number of oysters here found, is low, rocky, and of small extent, with jungle grass on its summit, and may be seen from a distance of about 5 miles. It is situated about 10 miles from the shore, and is surrounded with dangers, specially off the south-east end, where shoal ground extends for a distance of about 3 miles. Oyster reef, on which the lighthouse stood before it was washed away, bears from Oyster island S.E. $\frac{1}{2}$ S., distant about 9 miles.

A LIGHT* is exhibited from a lighthouse constructed of wood, on the centre of Oyster island. The light is a *fixed white* light, elevated 75 feet above high water, and should be visible in clear weather from a distance of about 10 miles. The illuminating apparatus is dioptric, of the fifth order. A blue light is burnt every half hour from 7 p.m. to 5 a.m., from a staging 24 feet above high water. Natives alone are in charge, so the exact time must not be depended on.

Caution.—Vessels approaching Oyster island from the southward and westward should be careful when making the light in thick weather, owing to the weak order of the light, also the great danger of Oyster reef. Endeavour to make certain of the position before standing towards the island, and, with the lead kept going, do not shoal to less than 20 fathoms, unless the light is sighted.

Mayu River, the entrance of which in about lat. $20^{\circ} 15' 30'' N.$, has shoals on each side, and a formidable bar on which are depths of about

* It is reported that the existing wooden lighthouse on Oyster island is to be replaced by an iron one (December 1885).

2½ fathoms, is 3 miles distant from the west coast of Akyab island. The Mayu is of considerable size, extending inland to the northward, parallel to the coast for about 55 miles or to near the latitude of Elephant point, and taking its rise in the mountains forming the northern boundary of the district. Strangers cannot enter without a pilot. Its mouth has occasionally been mistaken for that of the Arakan river.

The bank facing Mayu river, and extending thence along the land to Arakan river, has heavy breakers upon it during the south-west monsoon, and even in the north-east monsoon should not be approached into a less depth than 6½ or 7 fathoms.

OYSTER REEF, the north end of which bears S.E. distant 7½ miles from Oyster island, is 2½ miles in extent N.W. by N. and S.E. by S., with 4 and 10 feet on its shoalest patches, on which the sea during the north-east monsoon does not always break. It lies West, 13 miles distant from Savage island lighthouse at the entrance of Akyab. The soundings 2 miles westward of Oyster reef are 12 fathoms, between Oyster reef and west coast of Akyab island 6 to 7 fathoms, and to the southward about a mile from the reef, 8 fathoms. The lighthouse which formerly marked Oyster reef was destroyed in a cyclone, May 1884.*

Buoy.—A conical red buoy, surmounted by a basket, is moored in 8 fathoms, about three-quarters of a mile south of Oyster reef, and is reported visible in clear weather from a distance of 4½ miles.

Heckford Patch† having over it a depth of 4½ fathoms, rock and coral, is 13 miles S.W. ½ W. of Great Savage lighthouse, and 9 miles E. by S. ¾ S. from Oyster reef. A second patch having 4½ fathoms, lies 1½ miles W.S.W. of Heckford patch. These patches are steep-to on the west side, with 10 and 15 fathoms close-to, and 6 to 10 fathoms between them and Akyab bar. Commanders of vessels of heavy draught are advised to be particular of the bearing of western Borongo island when approaching from the westward, and warned not to pass over the shoal as Great Savage lighthouse is not visible when you are close to the south-west of it.

AKYAB,‡ situated on the right bank of the Arakan or Kaladan river, and 3½ miles north of Savage island lighthouse, is a town of considerable importance in connexion with the rice trade. It is the head-quarters of the Arakan Division and of the Akyab District.

* Oyster reef lighthouse was an iron screw pile structure erected in 4 fathoms water, similar to the Krishna shoal lighthouse of the gulf of Martaban, which met with a similar fate.

† Discovered by Captain N. Heckford, in February 1855, who remarks that probably less than 4½ fathoms may be found on it.

‡ See plan of Akyab, scale, $m = 3$ inches on Admiralty chart No. 1884, of Arakan river, scale, $m =$ one inch.

There are several landing jetties abreast the anchorage; also a court-house, jail, custom house, and hospital for Europeans. Telegraphic communication is established with England and all parts of India. The population numbers about 20,000.

The town of Akyab, the name of which is supposed to be a corruption of Akhyat-daw, the name of a pagoda in the neighbourhood, but called by the Burmese Tsit-tive, because the British Army encamped here in 1825, was originally a fishing village, but chosen as the chief station of the Arakan Province in 1826. In parts it is below the sea level at high water, and is laid out in broad raised roads with deep ditches on either side. The climate is considered malarious.

Trade.—In 1877, exports were valued at 716,215*l.*, imports at 667,133*l.* The exports are rice and timber; imports, machinery, coals, vegetable oils, canes, tobacco, piece goods, &c.

Supplies.—Provisions are scarce and expensive, and the water is indifferent in quality. Only slight repairs to ships can be effected.

Coal, in moderate quantities, can be obtained at about Rs. 23 per ton.

Kaladan river is the largest and most important of the rivers which rise in the Arakan hills. It is navigable only for vessels of light draught. Fakir point, the north entrance point, is low, with a flagstaff and a masonry tower on it; Hodge point is also low, and has several rocks and islets off it; on the largest, named Savage island, 66 feet high, there is a lighthouse. Both Savage island and White rocks appear white when the sun is in the west, the latter resembling a vessel under sail. Passage rock is 10 feet above high water.

SAVAGE ISLAND LIGHT.*—The lighthouse is a masonry tower, 50 feet high, painted white, and exhibits at an elevation of 99 feet a *fixed white* light, varied by a *flash every minute*, visible in clear weather from a distance of 14 miles. The light is obscured between the bearings N.N.E. through east to E.S.E.

Bar.—Shoal water extends from Fakir point $4\frac{1}{2}$ miles in a south-westerly direction, when it trends 3 miles to the eastward. The sea breaks heavily over the east part of the shoal during the south-west monsoon.

A red buoy with staff and globe is moored off the eastern part of the above-mentioned shoal; between the buoy and Borongo island is the bar, with from 18 to 28 feet on it at low water.

DIRECTIONS.—Vessels bound to Akyab during the south-west monsoon should steer for Borongo island, which has a table land at its northern end, visible 30 miles and distinguished by a beacon, but not approach

* It is reported that Savage island light is to be raised and replaced by a light of the 1st order (December 1885).

within 5 or 6 miles of it, and keep along the coast at the same distance, taking care to avoid Heckford patch, until Savage island lighthouse is seen. The lighthouse should be steered for, bearing N. by E. until the outer red buoy is sighted, when Fakír point flagstaff should be brought in line with the lighthouse, bearing N. $\frac{3}{4}$ W., which will lead over the bar in 27 feet at low water.

After crossing the bar steer N.N.W. to avoid the reef extending one mile south of Savage island, and which is steep-to; great caution is here necessary, as the flood tide sets towards and over the reef.*

When the lighthouse bears East, steer North and N.N.E. until it is seen eastward of Passage rock, then steer N.E. by E. to avoid Fakír reef, marked by red buoy with staff and globe. When Fakír point bears N.W., haul to the northward for the anchorage, leaving the black buoys marking the extremity of the reef extending from Flat island, on the starboard hand.

A vessel may anchor with the Savage light S.S.W., or the North and South Hammocks in one, in 5 fathoms. The deepest water for large ships is off the Charúgyea creek, within 70 yards of the shore.

A safe passage for boats and small schooners is found between Savage and the north end of Borongo island, sheltered from the sea in the south-west monsoon.

Tides.—It is high water, full and change, at Akyab, at 9h. 57m.; springs rise 8 feet, neaps 5 feet. In the rainy season (April to October) the rise is from 2 to 3 feet more. The streams are regular, and run swiftly at springs, when they form heavy overfalls on the ebb, between Fakír reef and Passage rock. During neaps, the streams are almost imperceptible.

Caution.—When coming in with the flood, great care is required in allowing for it, as it sets on to the White rocks. In coming out with the ebb tide, keep as close to the rocks as prudence will allow, in order to prevent being set on the Western bank.

Winds and Weather.—The south-west monsoon begins early in May, and lasts until the end of October. About the time of full and change of the moon, it will often be found that the south-west monsoon increases in strength, blowing more from the south, accompanied by heavy rain and sea, making it at such times necessary to approach the coast with great caution. In the north-east monsoon the wind blows nearly round the compass. Commencing at North in the morning, and hauling gradually to the South and East towards noon, then calm until the sea breeze sets in from West and S.W., hauling round to N.W. in the

* Steam ships of small power should have plenty of steam at command when entering or leaving Akyab, as the tides and whirls are very strong.—(Remarks by Commander Stopford, H.M.S. *Arab*, January 1884.)

evening. These winds prevail with regularity from November to April or May.

The rainfall in the south-west monsoon is very heavy. At this period the whole country becomes almost inundated, and the various rivers send down large volumes of water. The average annual rainfall is about 155 inches.

Passages.—For information respecting passages to and from Akyab see page .

BORONGO ISLAND, forming the south side of entry to Akyab, is 17 miles in length N.N.W. and S.S.E.; the table land which its northern end assumes the shape of, some 826 feet in height, can be seen from a distance of 30 miles, and forms a conspicuous landmark in approaching the port. Almost the whole island, which is narrow, is high and thickly wooded. At its southern end is a hummock, and detached rocks with foul ground extend 3 miles south, from the southern extremity of the island.

A basket beacon 8 feet in diameter, painted black and yellow, in vertical stripes, stands on the top of the old white light tower on the table-land of Borongo island, as a guide to vessels nearing Akyab. The height of this beacon above high water is 826 feet.*

The Coast. — Immediately eastward of Borongo island is Peni Kyong, a similar high thickly wooded island, separated from Borongo by Research strait, which is deep at its southern, but blocked by shoals at its northern end. Duff island lies off the south end of Peni Kyong island, and Barn island about 75 feet high, of reddish colour, with South rocks, which are white and flat, and a rock awash (doubtful), continue in a S.S.W. direction for a distance in all of $8\frac{1}{2}$ miles from the south point of the island. Angrei Kyong forms a similar island eastward of Peni Kyong, again separated by a strait in which is anchorage in 6 fathoms at its southern end, but shoal water in the northern part which narrows considerably, and finds exit in the mouth of the Chankhua-dan river, eastward of the port of Akyab.

Hunter Bay, 11 miles across east and west, inside Angrei Kyong, is but little known, and seldom entered by seagoing ships, the trade of the chief towns within it being carried on by native vessels. The central part of the bay is shallow, with narrow channels indicating the entrances to the numerous small rivers or creeks, which flow into it. On the eastern side of the bay, the land is high with a bold coast. The south peak of the lofty ridge which lines this shore, Keuain Kaun Taung, bearing E.S.E. distant 32 miles from the table land of Borongo island, is conspicuous, and visible 40 miles in clear weather.

* It is reported that this beacon is no longer discernible,

COMBERMERE BAY forms a considerable inlet, the head of which branches into numerous small straits and rivers, the most important of which is the Aeng, which is navigable by boats as far as the town of the same name, situated on the left bank, 23 miles from its mouth. Depths of from 5 to 12 fathoms are to be found in Combermere bay, but many islands, shoals, and groups of rocks are scattered over it, for the position of which the chart is the best guide. The navigation of the bay is intricate and dangerous, and it is rarely entered by European ships, the trade of the district being carried on by native craft.

Wood Harbour* to the north-east of Tangaro island, affords anchorage on a ridge of from 5 to 8 fathoms, mud, with the eastern extreme of Catharine bluff (at the north end of Tangaro island, bearing W. $\frac{1}{2}$ N., and a gap in the hills of the same island bearing S.W. by W. $\frac{1}{2}$ W.

The entrance to this harbour is easily distinguished by the bluff extremes of Narkumbau and Tangaro islands. Before closing the entrance, the north end of Tangaro island should be brought to bear E. $\frac{1}{4}$ S., in order to avoid some irregular soundings extending N.W. of Crooked island.

At springs the tide runs through the entrance of Wood harbour with a strength of about 3 knots.

KYAUKPYU HARBOUR, meaning "White Stone," is a well-sheltered anchorage, formed by the north end of Ramree island on the south, and on the north, by a chain of smaller islands; the latter extend for a considerable distance to the north-eastward into Combermere bay, forming between them numerous small straits and boat passages. The harbour is open only to the W.N.W., and vessels at the anchorage are, from that quarter, well protected by Dalhousie point, the north-west extreme of Ramree island.† The upper, or eastern portion of the harbour, narrows to about $1\frac{1}{4}$ miles in width at 3 miles eastward of the anchorage, whence it abruptly turns to the S.E., forming, for boats, a broad, safe, and convenient passage (Fletcher Hayes straits) 18 miles in length, and communicating by means of a smaller creek with the large inlet on the south-east side of Ramree, which inlet enters the sea near Chedúba island. The native village of Kyaukpyu is small, and the only European residents are two or three Government officials. There is a gaol and school. The town police number 83, and there is a district force of 275. The trade is of little importance, as the produce of the surrounding country is taken to Akyab in native boats through the numerous creeks and inlets; the harbour is therefore but seldom resorted to by shipping.

* Commander A. Carpenter, R.N., 1885.

† See Admiralty charts:—Kyaukpyu harbour, No. 831; Elephant point to Chedúba No. 821. The remarks on Kyaukpyu harbour chiefly by Navigating Lieutenant F. W. Jarrad, R.N., 1877.

The entrance to the harbour, between Reef island (to the north) and Saddle island (to the south) is nearly 7 miles in width, though the navigable channel is considerably contracted by dangerous reefs extending off both islands; great caution, especially in a sailing vessel, is necessary when approaching the entrance.

Reef island, small, low, sparsely wooded, and of reddish earth, is not conspicuous when making the coast, as it is hidden by the higher wooded peaks of the islands to the eastward of it. Dangerous reefs are said to extend for 2 miles to the north-west of Reef island, and as the locality has not been closely examined, vessels making the port should not approach the island within 3 miles in that direction.

Saddle island, 156 feet high, is easily recognised from a distance of 10 miles in moderately clear weather; the island is half a mile long, 300 yards broad, and has two rounded summits, sparsely covered with trees at its north and south extremes, between which is a lower ridge. From its south extreme, reefs of rocks above water extend in parallel ridges for fully one mile. Two small rocks, 6 and 5 feet high, lie $4\frac{1}{2}$ and $6\frac{1}{2}$ cables respectively from the north end of the island, whence shoal water extends for nearly $1\frac{1}{2}$ miles in a north direction. In consequence of numerous sunken dangers which surround this island vessels should not approach it too closely.

Dacey shoal, the northern of the dangers off Saddle island, is a detached patch of shoal water on which the sea rolls heavily; it has not been closely examined. A black nun buoy, with staff and ball, is moored off the north side of this shoal, in 10 fathoms at low water ordinary spring tides, $3\frac{1}{2}$ cables from the nearest breaking rock, and N. 3° W. distant $1\frac{1}{2}$ miles from Saddle island.*

Research rock.—A sunken reef, believed to be about one third of a mile in extent, lies about S. $\frac{3}{4}$ E. $5\frac{1}{2}$ miles from the south point of Saddle island with soundings of 7 to 11 fathoms close to.

Cap and Knot islands are two small islets lying S.E. by S. and S.E. by E. $\frac{1}{4}$ E., $1\frac{3}{4}$ miles to the eastward of Saddle island, and about one mile from the shore of Ramree island. The former (148 feet) is bold and conspicuous, while the latter is low with a few shrubs on it; both islets are surrounded by reefs. Between Saddle island and the coast of Ramree, numerous isolated rocky patches exist, and there is no safe channel in this direction.

Ramree island.—The northern part of this island forms the south shore of Kyaukpyu harbour. The coast from abreast Cap island, trends to the northward and eastward in a succession of sandy beaches and rocky points for a distance of 5 miles to Dalhousie point. The shore is fringed

* The exact position of the buoys cannot be relied upon.

with off-lying rocks, which, in some places, extend 2 or 3 cables from the coast.

Dalhousie point is low and sandy, with a large clump of palm trees and the remains of a fort, on it; at $1\frac{1}{4}$ cables to the south-east from the point is an iron pier. The whole of the north shore of Ramree is thickly wooded, and when entering the harbour, the high trees on Dalhousie point render it easy of recognition. The sea is making rapid encroachments on the shore westward of Dalhousie point.

From Dalhousie point a sandy beach, with a foreshore of mud which dries out from $1\frac{1}{2}$ to 2 cables at low water, trends E.S.E. for $1\frac{1}{2}$ miles to the mouth of the Ungyaung creek. The village of Kyaukpyu is built on this beach amongst tall palm trees.

Pagoda rock, lying $4\frac{1}{2}$ miles N.E. $\frac{1}{2}$ N. of Saddle island, is a small but conspicuous landmark for making the harbour, and, as its sea face is occasionally white-washed, is an excellent guide. The rock is 85 feet high, of conical form, with two sharp-pointed summits close together, and is steep-to, except on its east side, where a ledge projects about a cable. The edible-nest swallow (*Collocalia unicolor*) is found here.

Crooked island, on the north side of the harbour, is low, and its west side is skirted by reefs and detached rocks, foul ground extending north-west of it for three-quarters of a mile. A low wooded ridge, about 50 feet high, extends from the middle of the island southward; on the north end of the ridge is a small white pagoda. The eastern and southern shores of the island are low and swampy.

Squadron rocks, low, narrow, and rocky, with a few shrubs and a solitary tree, lie parallel to the south point of Crooked island, from which it is separated by a shoal channel about one cable wide.

A rock awash at low water lies $2\frac{1}{2}$ cables from the south end of Squadron island.

Quoin island, of triangular shape, thickly wooded, and the summit of which is 260 feet high, lies south-east of Crooked island, from which it is separated by a narrow channel. When viewed from seaward, Quoin island appears wedge-shaped, and has lighter foliage than the hills behind it. From its south point a ledge extends for a quarter of a mile to the south-east, at about which distance, the water deepens suddenly to 12 fathoms.

Caution.—The above islands should not be approached closely, as they have not been thoroughly surveyed.

Tangaro island, a long, narrow, thickly-wooded island, of irregular shape, varying from 50 to 465 feet in height, lies about 3 cables to the eastward of the above islands, and with them forms the northern shore

of Kyaukpyu harbour. To the south and east of Tangaro are several islands with narrow channels between them.

Laws island, having a conspicuous tree on its summit covered with foliage, is useful as a leading mark in entering Kyaukpyu harbour. If kept on a bearing of E. $\frac{1}{2}$ S., it leads half a mile north of Dicey shoal, and clears both North shoal and Reliance shoal by a distance of 3 cables.

North shoal, consists of a rocky patch about 2 cables square, one or two heads of which just uncover at low water springs. It lies $1\frac{4}{10}$ miles West of the South point of Quoin island, and may be cleared by not bringing that point to bear anything eastward of E. by N. when passing the vicinity.

A red buoy with pole and basket, is moored one cable South of North shoal.

Bombay shoal consists of a narrow tongue of rocky ground extending on the south side of the channel, two-thirds of a mile N. by W. of Georgina point, being the continuation of the ledge off that point. It rises abruptly from 14 and 8 fathoms, and has as little as 11 feet over its extreme at low water, the position of which is generally marked by overfalls.

Reliance shoal, almost midway between Quoin island and the north point of Ramree island, is a bank of 5 to 7 fathoms, having a pinnacle of rock with 8 feet over it at low water. A swirl of water, at both flood and ebb, indicates its position. North of Reliance shoal the water is deep, there being in some places as much as 40 fathoms. It may be cleared, by keeping the frontage of the native town south-east of Dalhousie point, well open of that point.

A black buoy with staff and ball, was moored in 1885, in 12 fathoms, N. by W. distant $1\frac{1}{4}$ cables from the 8 feet pinnacle of the Reliance shoal.*

The passage south of Reliance shoal is dangerous.

Giles bank, lying in the entrance to Kyaukpyu, has a least depth of $1\frac{1}{2}$ fathoms, coarse sand and shells. The shoalest part bears N. $\frac{1}{2}$ E. distant $2\frac{1}{4}$ miles from Saddle island, and W.S.W. $2\frac{7}{10}$ miles from Pagoda rock. It may be passed over by vessels of almost any draught, except during the south-west monsoon.

Anchorage.—The best anchorage is to the south-east of Dalhousie point, near the shore in from 9 to 11 fathoms (low water), mud bottom, with the pier bearing West to W.N.W. This anchorage is subject to strong eddies at springs, but at neaps there is very little movement of the water. The bottom is of sandy mud, and the anchor should be sighted after every spring tide to insure its being clear.

* The exact positions of the buoys cannot be relied upon.

Vessels may anchor in Southampton road, just inside Dicey shoal, but the holding-ground (broken shells and stones) is not good. Vessels unable to reach the harbour before nightfall may anchor, in fine weather, on the flat off the entrance to Combermere bay, in from 7 to 9 fathoms, mud bottom, good holding ground.*

DIRECTIONS.—Approaching Kyaukpyu from the southward, a steam vessel may pass inside the Terribles at about 2 miles east of them, taking care to avoid Irrawaddy shoal (on which the sea breaks heavily at times) by keeping the summit of Nondogi island (in Combermere bay), a high conspicuous wedge-shaped mountain, just open to the westward of the extreme north point of Satellite island.† After passing this danger, steer to the northward until the single tree on Laws island bears E. $\frac{1}{2}$ S. when steer for it on that bearing. A sailing vessel, however, should not attempt the passage inside the Terribles, as the coast and dangers have been imperfectly examined.

Making the port from the northward or westward a vessel should steer in until Pagoda rock bears East, taking great care to avoid the dangerous sunken rock which lies $1\frac{3}{4}$ miles North from North Terrible rock. When Saddle island bears South, alter course to E.S.E., to pass south of the red buoy guarding North shoal, and bring the tree on the summit of Laws island on the bearing of E. $\frac{1}{2}$ S., which leads well to the northward of Reliance shoal, then steer for Dalhousie point (which is steep-to), and haul to the south-east for anchorage off the pier as above directed.

Tides.—It is high water, full and change, at Kyaukpyu pier, at 9h. 26m. (approximate). Springs rise 10 feet 6 inches, neaps rise 6 feet 6 inches, neaps range 2 feet 6 inches. The velocity of the tidal stream varies from one to 3 knots an hour; the flood outside Saddle island, setting to the northward, the ebb to the southward. The movement of water is remarkably slack at neaps.

Supplies of any kind are scarce, but occasionally beef of inferior quality may be procured. A few fowls, ducks, and also vegetables can be obtained. Repairs to ships cannot be made at Kyaukpyu.

Good water is obtainable from wells.

Exports for 1883–84, chiefly to Akyab and Chittagong, consisted of hides, horns, petroleum, salt. Paddy and timber are also sent to Akyab for export.

* A buoy marking the boundary of the port lies a quarter of a mile north of the pier in $13\frac{1}{4}$ fathoms at low water, vessels can anchor inside the buoy.

† The summit of Nondogi island just open westward only, and not the whole island which latter would lead almost over the south breaker of the Terribles.

Commander Taylor (late I.N.) remarks "Nondogi peak on with second notch from west end of Long island, or that peak seen left of Reef island, leads clear to westward of Saddle island reefs and eastward of Irrawaddy shoal. If the whole of Nondogi island is seen to the left of Long island, you will be led too close to the southern breakers of the Terribles."

Communication.—Telegrams are sent to Akyab and Rangoon by weekly post for transmission. The British India steam vessels to Calcutta and Rangoon call weekly. A small steam vessel plies through the Wembaik creek to Ramree, Taungup, and Chedúba.

THE TERRIBLES,* about 13 miles distant to the westward of Kyaukpyu, form three visible groups of rocks, extending in a N.N.E. and S.S.W. direction. The northern rock, about 12 feet above water, is the largest, from which a spit projects to the north-west for some distance, while other rocks under water have not been thoroughly examined. The middle group is about a mile S.S.W. from the northern rock. The south group consisting of several low rocks, is $4\frac{1}{2}$ miles S.S.W. $\frac{1}{4}$ W. from the northern, and breakers have been seen one mile to the south of it, as well as at 2 miles west, and at half a mile north, of the northern rock. The northern Terrible rock, in about lat. $19^{\circ} 27' N.$, long. $93^{\circ} 18' E.$, bears from Saddle island W. $\frac{1}{4}$ N., distant 8 miles.

Unless bound for Kyaukpyu harbour or Chedúba strait, the Terribles should not be approached nearer than a depth of 20 fathoms to the southward, or 24 fathoms to the westward; and vessels are cautioned against a too close proximity to them during the night, when working up the coast.

Irrawaddy shoal of rock and small stones, consists of two patches lying one mile apart, in a north and south direction. The northern patch of broken rock, with a depth of $2\frac{1}{2}$ fathoms (possibly less), lies with Saddle island summit bearing E. $\frac{1}{2}$ N., distant $3\frac{3}{4}$ miles. The southern patch is a narrow ridge with a depth of 4 fathoms lying, $3\frac{3}{4}$ miles W. by S. $\frac{3}{4}$ S. from Saddle island, and is generally marked by tide rips. The swell breaks on the northern patch in heavy weather.

Inside passage between the Terribles and Saddle island, having depths of from 12 to 15 fathoms, may be made use of, keeping on the west side of the Irrawaddy shoal, or between that danger and the Terribles, in favourable weather only, the passage here being $3\frac{1}{2}$ miles in width; but the passage eastward of the Irrawaddy shoal, or between that and Saddle islands, not having been sufficiently examined, should not be attempted.†

Research rock, a sunken reef believed to be one-third of a mile in extent, lies about S. $\frac{3}{4}$ E., $5\frac{1}{2}$ miles distant, from the south point of Saddle island.

RAMREE ISLAND the northern shore of which forms the south side of Kyaukpyu harbour, the south-west shore the eastern side of Chedúba strait, and the south-east shore the western side of Ramree

* A lighthouse has been proposed for the Terribles.

† Between Irrawaddy shoal and Saddle island are more patches, and although not less than $4\frac{1}{2}$ fathoms has yet been obtained, shallower water may exist.—(Commander A. Carpenter, R.N., 1885.)

harbour, is 42 miles in length north-west and south-east, by from 7 to 15 miles in breadth. The island is crossed by a range of mountains elevated from 500 to 1,500 feet. The north-west coast of Ramree from West point southward, trends S.E. $\frac{3}{4}$ S., is tolerably straight, and appears rocky, with a few detached rocks above water lying near the shore. Depths of 7 and 8 fathoms are found at about 3 miles from this part of the coast, which rises somewhat steeply from the sea to a range of high hills, the most prominent peaks of which are known as Outer peak, North Pap hill, and Tree summit.

The town of Ramree, situated about 13 miles up a river on the eastern side of the island, has a population of about 4,000, and carries on a small coasting trade with Chittagong, Sandoway and Bassein.

Thames point about 16 miles south-east of West point is low, and has some tall trees growing on it.

Rocky point, 10 miles to the south-east of Thames point, and forming the north-east point of Chedúba strait, is low, and has no distinguishing feature, but a beacon was erected on it in 1884. The bight formed between Rocky and Thames points has depths of 4 fathoms, at the distance of 2 miles from the shore.

A table mountain 8 miles N. by E. $\frac{1}{4}$ E. of Rocky point is conspicuous when seen from the north-west.

Shoals North of Chedúba island.—At 6 miles and $7\frac{1}{2}$ miles N.W. by N. of Beacon island, off the north-west coast of Chedúba island, are two small shoals, which break in heavy weather. The northern has 4 fathoms over it, rocky bottom; the southern has 5 fathoms, mud. Between these shoals and Beacon island, the ground appeared clear of danger.*

CHEDÚBA ISLAND,† moderately high, is situated southward of Ramree island on the Arakan coast and is 18 miles long, extending between lat. $18^{\circ} 40' N.$ and lat. $18^{\circ} 55' N.$ Its west coast is high, gradually rising from the north end which is low, to its south end where the S.W. peak called Palangutaung rises to a height of 850 feet. The eastern coast is flat, and the greater part of the island is cultivated, and covered with foliage.

Centre peak is conspicuous, solitary, and 820 feet high. Pagoda peak, about 720 feet high, has two small pagodas, with a single tree between them on its bare summit.

Between Chedúba and Ramree islands are the Chedúba straits, navigable for vessels of moderate draught.

* See Admiralty chart No. 832 of Chedúba strait and Ramree, scale, $m = 0.4$ inch.

† Remarks on Chedúba island, strait, and adjacent islands and dangers, from Commander A. Carpenter, R.N., December 1884.

Chedúba town (Man-aung) stands on the banks of a small stream flowing into the straits, and the produce of the island, which is chiefly rice, is carried to Kyaukpyu and Akyab for exportation. Cattle, poultry, and fruit can be obtained at reasonable prices, also wood, but good fresh water is scarce during the dry season.

COAST.—From the north-west point of Chedúba island (which is low, and has an extinct mud volcano upon it,) the land trends E.N.E. 8 miles to Searle point, and thence in a slight sweep E.S.E. 8 miles to Sandy point, which is low. The soundings on the whole of the north shore are shallow, and west of Searle point the offshore is very foul.*

Off the north-west point of Chedúba there is extensive shoal ground, covered with large boulders, some of which show above water. In the centre of this shoal ground, is a space nearly clear of rocks, termed port Childers, but it is a dangerous and unnecessary anchorage, and the mariner will do well to avoid it. If desiring to anchor in that vicinity, there is excellent holding ground off Searle point, north of the island, or one mile N.E. of Beacon island.

Beacon island,† having on its highest part, a small stone beacon 17 feet high, painted white, is a stony islet, 4 cables long and 30 feet high. It lies 4 miles N.E. by N. of the N.W. point of Chedúba island. Bearing W. by N. $\frac{3}{4}$ N. 8 cables from Beacon island, is a rock which covers at high water spring tides, having three heads close together. This is the outer danger.

Henry rocks, 3 miles W.S.W. of the N.W. point, have a pinnacle standing 17 feet above high water. Six cables S.W. of this pinnacle are two rocks which never quite cover. From the outer rock, W. by N. of Beacon island, the danger line extends southward 5 miles to the outer limit of Henry rocks, and thence south-east parallel to the west coast of the island. The outer danger along this coast is a submerged rock abreast of West hill, distant $1\frac{1}{4}$ miles from the shore.

West coast of Chedúba island is a bold shore, faced by numerous detached masses of sunken rock. Native craft familiar with its dangers frequent it during the north-east monsoon for rice. West hill, nearly half way down the coast, is 695 feet high, and is wooded. South peak (Palangutaung) at the south end of the island, is 885 feet high, and visible from beyond the limit of soundings. These mountains are

* The work of erecting a lighthouse on Chedúba island, in 1884 had been stopped owing to want of funds.—(*Official Report on the Lighthouses of British Burma, 1883-84, page 1.*)

† Vessels navigating the coast outside Chedúba island, should not bring the western shore of that island southward of the bearing S.E. $\frac{1}{4}$ S., to avoid the rocky patches north-west of Beacon island.

excellent marks for vessels making the island from the west or south-west.* The only bay on this side of Chedúba is at its south-west end, immediately westward of South peak, where Pyramid bay (so named from a pinnacle rock 208 feet high, lying off it) affords good anchorage to native craft during the north-east monsoon. South of Pyramid rock is a reef, that extends off the south end of the island for about 2 miles.

The south point of Chedúba island is very foul, and there is no passage between it and Flat island. From the south point, the coast trends northerly, forming the west side of Chedúba strait, the first four miles being high, and the remainder low and thickly wooded. A creek leading to Chedúba town flows into the sea 10 miles up this coast. The town stands on its north bank about 2 miles from the mouth. A pagoda, half a mile north of the entrance is conspicuous when newly whitewashed (every autumn). There is shoal ground off this coast extending out to Round island.

The shallow ground extending from the east side of Chedúba island is prolonged in a south-east direction for upwards of 7 miles from the S.E. extremity of the island. Upon it are three islands.

The tidal stream on the west side of Chedúba island follows the general trend of the land, and flows at rates similar to what prevail in the vicinity of Beacon island. The north-east monsoon, though not affecting the regularity of the land and sea breezes, appears to induce a set to the southward. The indraught between Chedúba island and Flat island, off its south end, is considerable.

Tokwekwong or Round island is one mile long with an even rounded summit, 290 feet high. There are 6 fathoms one mile east of it, and the island forms a useful mark.

Flat island, the middle of the three islands is low, 4 miles in length north and south, and has a slight elevation in the centre, 105 feet high.

Hill island, three quarters of a mile south from Flat island, is 80 feet high.

The edge of the shallow ground is steep, and should not be heedlessly approached. On the eastern side, the depth at a short distance from it is 5 fathoms; on its south-east side, half a mile from Hill island, 8 fathoms will be found; while on its south-west and west sides, soundings of 12 to 16 fathoms have been obtained close off it.

The distance between Chedúba and Flat island is $3\frac{1}{2}$ miles from shore to shore. Vessels must not attempt to pass through, as it shoals gradually from 8 to $1\frac{1}{2}$ fathoms. Hill island ought not to be approached on its

* The heights of these hills were formerly much overstated.

southern and western sides nearer than a mile. A rock, 8 feet high, lies half a mile south from the island.

Volcanoes.—Several extinct mud volcanoes exist amongst these islands, but one larger than the rest on Chedúba is in activity, according to native report, twice a year. The *Investigator* witnessed an eruption from it in December 1884, the flaming gas reaching a height of 500 feet, and lasting four minutes. This volcano is situated near the southern end of the island.

CHEDÚBA STRAIT.—This strait extends from the north point of Chedúba as far south as Unguan or Tree island, south of which there is no protection afforded from the south-west monsoon. The portion between Searle point and Round island is alone intricate, the least depth of the channel being $3\frac{1}{2}$ fathoms at low water spring tides, and the width of the deep channel one to 2 miles.

A table mountain $7\frac{1}{2}$ miles N. by E. of Rocky point is a conspicuous object when seen from the north-west, but Rocky point has no features by which it can be recognised. Helby hummock, small and wooded, is conspicuous when approaching from the northward, and will, with the highest part of Ramree hills, afford objects for obtaining cross bearings. Button island, 115 feet high, lying under Ramree hills is useful when coming from the southward, but is not easily distinguished from the westward. A beacon was placed on Rocky point in 1884.*

Three miles S.S.W. of Rocky point is a shoal patch of 3 fathoms, and from this a line of shoals which narrow the 4-fathom channel to 6 cables, and the 3-fathom channel to 8 cables, trends about E. by S. and W. by N., and its eastern extreme bears S. by E. from Helby hummock; the least water on these patches is $1\frac{1}{4}$ fathoms. The coast of Ramree north of Rocky point is clear, and has 4 fathoms at a distance of 2 miles. Rocky point has 4 fathoms at $1\frac{1}{4}$ miles south of it, with shelving bottom.

DIRECTIONS, from northward. — When approaching Chedúba strait from the northward, Chedúba hills will be seen ahead, Centre peak being the most conspicuous and isolated, with Pagoda peak immediately west of it. To the south-east, the high Ramree hills adjoining the strait will be noticeable, falling somewhat abruptly to the water, no other hills being visible to the southward of them, except those of Chedúba island. The summit of the Ramree range is marked by a slight lump. Helby hummock, will be seen in the same direction, with a moderate sized wooded hill to its left, both being seen over the low ground of Rocky point. There is a small shallow bay east of Rocky point, beyond which,

* The beacon on Rocky point (staff 30 feet high with basket) has been rebuilt and whitewashed. (Commander A. Carpenter, R.N., March 1886.)

another slight point projects,* having a high sand beach on it. The small hummock bears N.W. from this beach.

Follow the coast at a distance of 3 to 4 miles until the highest part of Ramree hills bears E. by S., when steer E. by S. $\frac{1}{2}$ S., for the dome-shaped hillock which marks the south extreme of the range.

A red buoy† with staff and basket, is moored in 4 fathoms at low water, to the northward of the central shoals north of Sandy point. From the buoy, the highest summit of the Ramree hills bears E. $\frac{3}{4}$ S. Vessels should pass 2 cables south of this buoy, then keep it just open of Rocky point until Helby hummock bearing N.N.W. $\frac{1}{4}$ W. comes in line with the wooded hill at its back, then haul to S.S.E. $\frac{1}{4}$ E., keeping the two in line to clear the east end of the shoals. A blunt conical hill will then be seen to the northward touching the left shoulder of the wooded hill.

This cone kept just touching, leads between the shoal water on the east coast of Chedúba, and the shoal middle ground between here and Sagu island, preference being given to the side of the middle ground, of which warning can be got by the lead. If bound to Ramree harbour, a vessel may haul up for it, when Round island bears S.S.W.

Approaching from southward.—Pass eastward of Round island at the distance of from one to 2 miles, and when it bears West, steer N.N.W. $\frac{1}{4}$ W. for the west extreme of Ramree island. A double hill will then be just lifting above the horizon. This double looking hill is the wooded hill mentioned above with the blunt cone touching its shoulder and forms the leading mark up to the shoals at the Narrows. Steer for it until the summit of the Ramree range bears E. $\frac{1}{2}$ N. when haul to W. by N. $\frac{1}{2}$ N. and keep the dome-shaped hillock astern.

RAMREE HARBOUR.—The south coast of Ramree island forming the north side of Chedúba strait, extends to within $1\frac{1}{4}$ miles of Sagu island leaving a deep channel between, in which is 20 to 40 fathoms of water. This is the entrance for large vessels into Ramree harbour. From the southward near Round island, a conspicuous isolated clump marks the whereabouts of this channel (locally known as “the gates”). From here, the harbour trends northward for 18 miles, with an average breadth of $3\frac{1}{2}$ miles, forming an arm of water separating Ramree island from the low swampy islands adjacent to the main land. There is excellent anchorage all over it, but it contains several shoals and rocks which must be avoided.

Sagu island is the largest of the group lying off the south point of Ramree, from which it is separated by a deep channel, $1\frac{1}{4}$ miles broad. Its greatest length is in a N.W. and S.E. direction, about $4\frac{1}{2}$ miles, its breadth

* The beacon on the west side of the next point, E.S.E. of Rocky point, has been rebuilt and whitewashed. (Commander A. Carpenter, R.N., March 1886.)

† Liable to be washed away.

being $2\frac{1}{2}$ miles. From the north point of Sagu island, Dragon shoal, of varying depth, having rocks and shoal patches throughout its length, trends N. by E. $\frac{1}{2}$ E. for 5 miles, terminating about a mile beyond, in a group of rocks above water, one of which is white. Some rocky patches of 3 fathoms extend out three-quarters of a mile from the Ramree shore 2 miles N.E. of the south point of that island, leaving a channel of 8 fathoms, about a mile wide.

Flat reef is a patch of rock, steep-to, and lies midway between the north point of Dragon shoal and the land to the north-west. It may be passed on either side, but the eastern, is the one recommended. The channel between it and the north end of Dragon shoal is 4 cables in width.

A beacon consisting of an iron tripod with drum, painted red, is placed on Flat reef, to mark it when covered at high water.

Kyangyaung point is a bluff on the western shore, 8 miles from the entrance of Ramree harbour, and has an islet lying half a mile distant from it. After passing Flat reef, do not bring this islet to the northward of N. by W. It is steep-to on its eastern side.

Oyster reef which covers at high-water spring tides, lies 3 miles N. by W. nearly of Kyangyaung point, and there is a sunken rock a mile farther north in the same line. For 5 miles N. by W. of these, a ship will carry $3\frac{1}{4}$ to 4 fathoms, but the channel is much narrowed by mud banks.

Wembaik creek running to the north-west from here, gives a short route to Kyaukpyu, and can be navigated by small steamers of 6 to 8 feet draught.

Ramree River debouches 8 miles north of Kyangyaung point. Vessels drawing 9 feet can get up within $1\frac{1}{2}$ miles of Ramree town at ordinary high water. The entrance to Ramree harbour east of Sagu island is filled with mud and sandbanks, through which, there are some narrow, tortuous channels, only fit for fishing boats.

Magyigyun is an island $2\frac{1}{4}$ miles long E.S.E. and W.N.W., and lies 2 miles south of Sagu island. This island is 270 feet high, whale-backed, and stands in the centre of a shoal bank, 5 miles long; off its west point lies a small islet, and the end of the shoal water is one mile west of this islet. Another small islet lies one mile S.W. of the centre of Magyigyun island, and marks the south-west edge of the shoal bank.

Gungasager rocks, a dangerous patch, 3 feet in height, lies $5\frac{1}{2}$ miles N.W. by W. of the Drunken Sailor. Vessels can pass a mile to southward of the dry rocks.

Osprey rocks, 8 feet high, $4\frac{3}{4}$ miles farther to the north-west, form another dangerous group. A third group, the Pandaw rocks, extend off an island of the same name, which lies 5 miles to the northward of Gungasager rocks.

DIRECTIONS.—Vessels proceeding to Ramree harbour from the south-east, should pass to the south of Gungasager and Osprey rocks and at least 2 miles westward of Magyigyun island, and make for the entrance north-west of Sagu island (the Gates). Steer through N.E. $\frac{3}{4}$ E. in mid-channel, till the north point of Sagu island bears S. by E. $\frac{1}{2}$ E.; then steer N. by E. $\frac{1}{4}$ E. taking care not to bring the north point of Sagu to the west of S. $\frac{1}{2}$ W., until arriving west of the White rock near the north end of Dragon shoal, when Flat reef beacon will be seen ahead; pass Flat reef at 2 cables distance, and the islet off Kyangyaung point at about half a mile.

Tides.—It is high water, full and change, at a position 3 miles northward of Sagu island in Ramree harbour, at 9h. 10m. Springs rise 11 feet, and neaps 8 feet. At the south entrance to Wembaik creek at 9h. 50m. Springs rise 12 $\frac{1}{2}$ feet, and neaps 9 feet. The stream of the flood tide sets to the north, and of ebb to the south, at springs, as much as 3 knots, and in the entrance to Ramree harbour 3 to 4 knots.

Kayaing creek, the entrance to which is about 12 miles south-eastward of the entrance to Ramree harbour, in its north-east arm, represents a part of the route to Taungup from Sandoway. This creek narrows to less than a cable, and within a mile of Taungup to about 50 feet, and is barely navigable for a steam launch.

The coast from the entrance to Kayaing creek trends in a S.S.E. direction in the form of long low islands for about 12 miles to Singaung, on the north side of entrance to Sandoway river.

Tides.—It is high water, full and change, at Singaung island at 9h. 28m. Springs rise 9 feet and neaps 6 $\frac{1}{2}$ feet.

DANGERS TO SOUTHWARD.—South-eastward from Flat and Hill islands, off the south coast of Chedúba, distant about 4 miles, and separated from them by a navigable channel 12 to 5 fathoms deep, known as the Heywood channel, is a line of reefs and a large rock, lying in the direction of S.S.W. and N.N.E.

West shoal, the southernmost danger, is a quarter of a mile across, and does not always break; at low water the points of the rocks are seen between the rollers. It lies 5 miles from Hill island in the direction of S.S.E. $\frac{3}{4}$ E., and deepens within half a mile to 12 and 14 fathoms. To clear it, unless intending to enter one of the channels to Chedúba roadstead, or Ramree harbour, vessels should avoid bringing Hill island to the westward of N.N.W.

Sail rock, 2 $\frac{3}{4}$ miles N.E. $\frac{1}{4}$ N. from West shoal, and nearly 5 miles S.E. by E. $\frac{1}{2}$ E. from Hill island, has 5 to 8 fathoms a quarter of a mile from it. Vessels should give it a berth of half a mile, to avoid sunken rocks that may have escaped the surveyor's attention. When West

shoal is breaking, Childers channel, east of the above rocks, is a good one. Round West shoal at the distance of a mile, and steer N.E. $\frac{1}{4}$ E., passing 2 miles clear of East reef.

Heywood channel is not recommended.

False rock, is distant 5 miles N. by E. $\frac{3}{4}$ E. from Sail rock, and 6 miles E. by N. $\frac{3}{4}$ N. from Hill island. It is a solitary rock 10 feet high, joined to Sail rock by a bank of shoals. There is 8 fathoms half a mile east of it, and 4 fathoms three-quarters of a mile N.N.W. of it.

There is no safe passage between Sail and False rocks, and this part is strewn with rocks.

Unguan or Tree island is three-quarters of a mile long. It is distant 11 miles S.E. $\frac{1}{2}$ S. from Hill island, and has a dense clump of trees on its summit, 130 feet high. A reef of straggling rocks extends one mile south-east from the south point, and foul ground half a mile N.E. of its north point, and the same distance N.W. of it.

East reef, three-quarters of a mile long, which uncovers at half tide, lies $4\frac{1}{4}$ miles N. by E. of Unguan island. It has 6 to 8 fathoms round it. A small shoal, Cutter's patch, on which the least depth is $2\frac{1}{2}$ fathoms, rock, lies $2\frac{1}{4}$ miles N. by W. $\frac{1}{2}$ W. from Unguan island. The channel between Unguan or Tree island and Nerbudda shoal is $3\frac{1}{4}$ miles wide, and is chiefly used by strangers, owing to Unguan island being easy to make.

Nerbudda shoal, $4\frac{3}{4}$ miles long, N.E. and S.W., is a bank of 6 to 10 fathoms, having several shoal heads upon it, and as little as $1\frac{1}{2}$ fathoms over its northern end. It bears S.E. by E. $\frac{3}{4}$ E., $4\frac{1}{4}$ miles from Unguan island. The south end having $2\frac{1}{4}$ fathoms, bears S. by E. $\frac{3}{4}$ E., $5\frac{1}{2}$ miles from Unguan island. The channel between this and Unguan island appears clear of danger, but Unguan island should be kept bearing north of N. by W. $\frac{1}{2}$ W. until within 2 miles of it, when a ship may haul to the N.E. or for Sandoway.

TIDES.—It is high water, full and change, at Searle point, the north point of Chedúba island, at 9h. 15m., springs rise 10 feet, and neaps 7 feet; off the mouth of the Sandoway river the time of high water at full and change is 38 minutes later.

The streams of tide on the Arakan coast setting to the northward during the flood, and to the southward during the ebb, are much influenced by the immense tidal tracts of backwater. The northerly stream is much affected therefore by local indraughts, though the southerly stream is but little altered by the outflows. There are no violent tidal streams between Kyaukpyu and Sandoway, but at the entrance, into Ramree harbour, at springs, a 3 to 4 knot tide will be found.

SANDOWAY, Thandwai (iron bound), is a district in the south of the Arakan division, 3,667 square miles in extent. The

face of the country is mountainous, the Arakan Roma range sending out spurs which reach down to the coast, these again throwing out a number of side spurs parallel to the Roma or main range, the whole drained by many small streams. From the mouth of the Sandoway river northwards, the coast is indented by numerous creeks, navigable for large country boats, which receive several small streams; by means of these, communication is kept up, boats going almost the whole way from Kyaukpyu to Taungup by backwater, the passage taking about four days; there is also backwater communication between Taungup and the town of Sandoway. None of the boats are built for sea work, and the natives are ignorant of landing from a boat in the surf. To the southward, the shore presents a rugged surface with few places of shelter. The rivers draining the country are but mountain torrents to within a few miles of the coast.

Sandoway River flows past the town of that name and falls into the sea at Singaung, about 10 miles to the north-west. The influence of the tide is felt a short distance above Sandoway town. The river is navigable for large boats; and small steamers of from 6 to 8 feet draught can proceed at ordinary high water to within 3 or 4 miles of the town.

B. I. steam vessels carrying the mail from Calcutta and Rangoon call off the entrance to the Sandoway river, except during the south-west monsoon, when the mails are brought from Kyaukpyu viâ Taungup, by backwater. There is no trade, except a coasting one by backwater, carried on in small boats unfitted to put to sea. Whenever the wind is to the westward of north, a heavy surf breaks along the coast, making the landing in boats hazardous.

Gwa-taung,* 610 feet high, formerly called on the charts Sandoway peak, is a good landmark for making the anchorage both from the northward and southward; it is the only hill of any considerable elevation on this part of the coast, and is recognisable from positions both north and south of the Drunken Sailor rock. At the north-west extreme of Gwa-taung is a headland called Zalattaung, which forms the south side of entrance to the river. The north side of entrance is formed by a dry sand spit, off which shoal water extends out to the Drunken Sailor rock. The channel to enter by, for large boats, is close to the Zalattaung shore.

Directions.—From the buoy on the south side of the Drunken Sailor rock steer for the Rest house until Zalattaung bears south, this will clear the outlying rocks, and then haul to the southward to pass round the

* Sandoway high land appears like three islands when viewed from the south and westward, but when approached from Chedúba strait the three seem one island.

sand spit of Singaung, between this spit and Zalattaung is a small depression with from $2\frac{1}{2}$ to 6 fathoms in it.

A steam launch drawing 3 feet can ascend the river to Sandoway with the flood; reaching Kinmaw, a large village, at nearly low water, and from thence a road will be found that leads to the town, a distance of 5 miles.

Drunken Sailor rock* is a patch, 6 cables long, the southern end of which lies one mile W. by N. $\frac{1}{4}$ N. of Zalattaung; the shoalest portion nearly dries at low water. During the north-east monsoon a red conical buoy with basket, is moored on the south side of the shoalest water.

Anchorage.—Vessels can anchor in about 6 fathoms, mud, to the northward of the Drunken Sailor rock, with the Rest house on the sand spit bearing S. 73° E., and a remarkable tufted clump of trees, on the coast, 2 miles farther north, bearing N. 62° E.

Steam vessels of the B. I. Co. visiting the port, anchor to the southward of the Drunken Sailor rock; this anchorage is good in the north-east monsoon, but in the south-west monsoon it is exposed and dangerous. A detached rock above water lies 6 cables south of Zalattaung point, and there is foul ground round it. In the south-west monsoon the port is considered closed.

Tides.—It is high water, full and change, at the mouth of the Sandoway river at 9h. 28m. Springs rise 9 feet, and neaps $6\frac{1}{2}$ feet.

Climate.—There are three seasons which follow each other with regularity, but with occasional variation in duration, and time of commencement.

The cold season from November to February, when the dews are exceedingly heavy and the nights chilly, the winds light, usually at first from N.W. and N.E., gradually veering round to west and east. From February to May, dense fogs rise during the evenings and mornings, and the wind comes from the west. Towards the middle of May, storms of thunder and lightning, with squally weather, and S.E. and S.W. winds usher in the rainy or warm season which ends about October, with still more violent atmospheric disturbances and strong winds blowing from the south and S.W., gradually becoming variable, till, toward the end of October they settle, and the cold weather begins.

The Population of the Sandoway district in 1872 was 54,725, and in 1877 the inhabitants of the town of Sandoway numbered 1,617.

* "At lowest spring tides, the rocks of the Drunken Sailor are awash and visible. At low water it breaks, and almost always has a blind roller over it."—(*Commander Taylor, late I. N.*, 1885.)

Trade consists chiefly in the export to Akyab and Kyaukpyu of rice, tobacco, sessamum, plantains, betel leaf, salt (made by boiling and partly by solar evaporation), salt fish, fish paste, dhaní leaves for thatching, and boat building.

The import trade consists of piece goods, twist, betel nut, crockery, and hardware, and various articles for domestic use.

THE COAST from Gwa-taung hill is low and sandy, and trends S.E. by S. for 9 miles to Apau-ye, a bluff islet with a bay to the north of it which is foul. A deep bay* not yet examined, lies E.S.E. of Apau-ye. This coast should not be closed within $1\frac{1}{2}$ miles, and then with caution.

Southward of the unsurveyed bay just alluded to, the coast forms a considerable promontory nearly 5 miles in length north and south on its seaward face, off which, foul ground apparently extends for about $2\frac{1}{2}$ miles. It then recedes for a distance of $6\frac{1}{2}$ miles, and sweeps to the southward for 16 miles, forming a bight, in the south part of which the Kyein-ta-li river which separates the province of Arakan from that of Pegu, disembogues. The small rivers of Ka-myt and Salu enter the sea at distances of about 12 and 10 miles respectively, to the north of the mouth of the Kyein-ta-li river.

Four-fathom shoal has irregular soundings of from 4 to 13 fathoms over rocky bottom, and bears from Nerbudda rock S.S.E., distant 9 miles. The channel between, though clear, is not recommended.

FOUL ISLAND,† nearly 2 miles in length north-east and south-west, and several hundred feet in height, bears from Unguan island S.E. by S. $\frac{3}{4}$ S., distant $25\frac{1}{2}$ miles.

On its north side is a bank of sand and mud, said to afford anchorage at the distance of half a mile from the shore, in 8 and 10 fathoms. In fine weather, Foul island is visible for a distance of upwards of 30 miles.

Brougham shoal, nearly awash, $3\frac{1}{4}$ miles N. by E. $\frac{1}{2}$ E. from Foul island, is a patch of rock, half a mile long, on which the sea breaks. It should be avoided.

Vestal shoal, also nearly awash, bears from the east point of Foul island E. by S. $\frac{1}{2}$ S., distant $5\frac{1}{2}$ miles. It is small, with breakers constantly on it, and 20 fathoms of water around it.

William shoal, on which is a depth of 3 fathoms rocky bottom, bears from the north-east point of Foul island E. by S. $\frac{1}{2}$ S., distant $11\frac{1}{2}$ miles.

* Sometimes termed Andrew bay, and said to afford good anchorage, protected from south-west winds by a reef which projects from its southern point.

† Foul island with the surrounding rocks, shoals, and islands to cape Negrais appear correctly laid down in the survey of Captain D. Ross, I.N.—(*Captain N. Heckford.*)

Satellite rock* upon which the sea was reported to have been seen to break, has a doubtful position 5 miles N. $\frac{1}{4}$ W. of William shoal, or about 12 miles E. by N. of Foul island.

Caution.—Vessels passing eastward of Foul island are recommended to keep within 3 miles of it, to ensure their clearing the Vestal, William, and Satellite shoals.

The COAST from the mouth of the Kyein-ta-li river rises considerably, and trending to the westward for about $2\frac{1}{2}$ miles, turns sharply at right angles or to the southward, forming Bluff cape, a headland which is discernible from a considerable distance. From Bluff cape the coast trends S.S.E. for $25\frac{1}{2}$ miles to Khwa or Gwa and should nowhere be closely approached. Reefs of unknown extent, and in close proximity to which is generally a depth of from 6 to 10 fathoms, line its projecting points. About midway there is a hill of peculiar form, known as Quoin hill, and farther inland are several peaks of considerable height. A rocky islet, opposite Quoin hill, and about a mile from the coast, is surrounded by reef, which extends from it upwards of a mile to the south-west.†

KHWA (Gwa) is a small town situated about a mile from the mouth of, and on the eastern bank of a river of the same name which empties itself into the sea in about lat. $17^{\circ} 35'$ N. Its mouth forms a small harbour, but the entrance is rendered difficult by a bar of sand on which at low water is a depth of $2\frac{1}{2}$ fathoms.

The town of Khwa or Gwa is surrounded by a grove of fruit trees, the houses are generally good, and the roads broad and crossing at right angles. During the north-east monsoon a little trade is carried on by sea with the Bassein District to the south, and Chinese junks occasionally anchor off the village. The population, consisting almost entirely of Burmese, in 1877 amounted to 1,303.

Anchorage in Khwa or Gwa bay outside the mouth of the river, may be had in from 4 to 6 fathoms, but is much exposed to westerly winds. In entering, it is necessary to guard against a reef of rocks which extend about three-quarters of a mile south of Rocky point (the north point of the bay).

Tides.—It is high water, full and change, at 11h. 30m. in Khwa bay; springs rise 6 feet.

Khwa or Gwa island, situated southward of the entrance to Khwa bay and about $1\frac{1}{2}$ miles from the coast, is half a mile in extent, of moderate height, and affords an excellent mark for vessels bound to Khwa bay from the south-west. A rock having over it 2 fathoms is situated a mile N.N.E.

* Searched for by H.M.S. *Childers* in 1859 for a week without success.

† Imray's Bay of Bengal Pilot, p. 113.

of Khwa island, and as foul ground extends between the island and shore and also around the island, the channel eastward of the island should not be attempted.

ST. JOHN OR CHURCH ROCKS are four in number, and cover the space of about a mile in a north-west and south-east direction. The largest, about 30 feet high, when seen from the north-east resembles a church; it bears from Khwa or Gwa island S.W. by W., distant $11\frac{1}{4}$ miles. Between the rocks and the coast are depths of 34 fathoms, soft mud, decreasing as the shore is approached. At a distance of 2 miles, westward of the rocks, is a depth of 59 fathoms. A vessel passing outside them in the night should not shoal the water under 60 fathoms.

THE COAST from Khwa bay or lat. $17^{\circ} 34' N.$ to abreast Koronge island in lat. $16^{\circ} 32' N.$, trends to the southward, and is irregular, rocky, and broken up into a series of unimportant bays, having little or no trade, and for details connected with which, the chart, though not perfect, is the best guide. In lat. $17^{\circ} 14' 30'' N.$ is Round hill, and another named Peak hill in lat. $17^{\circ} 10' N.$ High island lies closely tucked in to the shore in lat. $16^{\circ} 57' N.$, and Broken point in lat. $16^{\circ} 55' N.$ forms the west entrance of an open bay, into the upper part of which, the Kyaung-tha river, a stream from 6 to 18 feet deep, flows. From the town of Kyaung-tha, Bassein is distant about 20 miles in a south-east direction. Communication between the two towns is difficult, being by road over a mountain pass, which is scarcely traversable after heavy rains.*

CALVENTURA† ISLANDS form two divisions off the coast near Broken point, bearing from each other north-west and south-east, distant 5 or 6 miles.

The north-west group in about lat. $16^{\circ} 55' N.$, long. $94^{\circ} 13' E.$, consists of seven irregular black rocks, one of which, about 100 feet high, resembles an old church with a mutilated spire.‡ The south-east group consists of two rocky islands, covered with vegetation, the southern of which is low and wooded, and connected by a reef with from 5 to 7 fathoms of water upon it. About half way between the two islands of the south-east group is a rock which dries at low water.

Mile Stone rock is high and black, in lat. $16^{\circ} 40' N.$, and distant about 3 miles from the coast between the Calventura and Koronge islands. Close to, on all sides, the Mile Stone rock has depths of 13 fathoms, and between it and the coast to the south-east are several reefs, some of which

* Imray's Bay of Bengal Pilot, p. 114.

† Also called Huget-taung.

‡ No soundings are shown between the Calventura islands and North-west group; in old charts breakers are inserted between, with North Calventura island bearing E. $\frac{1}{2}$ S. distant $2\frac{1}{2}$ miles.

are above water. In running down this part of the coast it will be well not to shoal under 20 fathoms.

KORONGE ISLAND, the north point of which is 7 miles S. by W. $\frac{1}{2}$ W. from Mile Stone rock, is about $2\frac{1}{2}$ miles in length, high, and appears rugged, especially when seen from the northward. It tapers to a point at its northern end, and lies about a mile distant from a cape, which has a bay to the northward of it. The channel eastward of the island is contracted by a shoal extending half way over from this point. This channel has a depth of 4 fathoms as shown by the chart, but it is imperfectly known, and should not be attempted by strangers.

Crawford shoal* partly uncovered at low water, spring tides, bears S. W. $\frac{1}{2}$ S., distant $3\frac{1}{4}$ miles from the south end of Koronge island. It has 15 to 18 fathoms close outside it to the west, and 11 to 12 fathoms inside, or east of it.

THE COAST from abreast Koronge island to cape Negrais trends about S. by W. and S.S.W., is rocky, and has some projections and indentations, with a few scattered islets and reefs extending from one to 3 miles off it, of which the Crawford shoal, just described, is the most dangerous, and farthest from the shore. Conical cape is $3\frac{3}{4}$ miles, E. $\frac{1}{4}$ S. of Crawford shoal, and has a white rock half-a-mile off it.

Saingbain Kieu, or Buffalo rocks, the north end of which bears S. $\frac{3}{4}$ W. from the south point of Koronge island, distant 6 miles, extend about 7 miles in a N.N.E. and S.S.W. direction. They are isolated and high, several of them being white, the two outer and south-western being termed the North and South Buffalo. To the southward of these the coast becomes more clear, and the mountain range which divides the coast from the Pegu district, approaches the shore. It is high and rugged, and broken into cliffs of reddish earth in many places, but without signs of cultivation.

Round Cape, about midway between Koronge island and cape Negrais, bears S.E. by S., distant 4 miles from South Buffalo, and has an islet off its south-west side, and a depth of 4 fathoms at the distance of a mile north-west of it. Bearing from Round cape S.S.W. $\frac{1}{2}$ W., distant 5 miles is Black rock, which is dark and easily distinguished; it lies a little more than 2 miles from the shore, and around it are depths of 8, 10, and 13 fathoms. On the ridge, distant about 4 miles from Round cape, is Conical mountain. Passing vessels should keep well to the westward of all the islands and rocks lying off this part of the coast.

CAPE NEGRAIS.—The Yoma or Roma range of hills which commences at the Blue mountain, in lat. $22^{\circ} 37' N.$, after extending south-

* See Admiralty chart No. 823, Koronge island to White point.

ward and gradually decreasing in altitude for about 700 miles, sinks into the sea at cape Negrais, the last bluff being crowned by the Hmaw-dau pagoda, on Pagoda point of the chart.* Cape Negrais, in lat. $16^{\circ} 2' N.$, projects slightly, is moderately bold, with a few rocks at its base and should not be too closely approached. From cape Negrais the coast trends S.E. by S. $\frac{1}{2}$ S. for 6 miles to Pagoda point, the southern projection, and is skirted by a shoal which terminates to the northward at the north end of the red cliffs near cape Negrais, and should not be approached under 10 fathoms.

Directions.—In beating round cape Negrais, a vessel may shoal to about 10 fathoms, and stand off to 18 or 20 fathoms. In sailing northward, especially at night, it is desirable to keep a good offing, frequently using the lead, and passing outside the various rocks which have been described. From the proximity of the mountains, the winds are baffling during the north-east monsoon, and in the south-west monsoon the weather is bad, so that the plan recommended in Horsburgh of working up inshore has been abandoned. Should it be deemed advisable to do so, it is best to keep in soundings proper for anchorage, and avail yourself of the alternating land and sea breezes, and the uncertain currents.†

SOUNDINGS.—The soundings northward of the parallel of cape Negrais are scarce. Neither the 10, 20, nor 100 fathom lines have yet been properly determined, the latter apparently extends to a distance of about 25 miles westward of the cape.

Juanita shoal.—Commander Harrington of the U.S. Navy, reported having sounded in the U.S.S. *Juanita*, in 25 fathoms, bottom coral and broken shells, in lat. $15^{\circ} 58' N.$, long. $93^{\circ} 43' E.$, or 27 miles W. by S. of cape Negrais, indicating that uneven ground may exist in the vicinity.‡

* From the extremity of the Arakan mountains near Chedúba, to cape Negrais, is a continuous ridge of craggy land, tolerably high, broken into cliffs of reddish earth in many places, and generally clothed with low trees or brushwood, without signs of cultivation or inhabitants towards the sea.—(*Horsburgh*, Vol. 2, 8th Edition, p. 668.)

† Findlay's Indian Ocean Directory, 4th Edition, p. 1115.

‡ Originally published in United States Hydrographic Notice No. 59 of 1883.

CHAPTER VII.

NORTHERN SUMATRA.—NICOBAR AND ANDAMAN ISLANDS.

—ACHI HEAD (N.W. COAST OF SUMATRA) TO TABLE ISLAND (COCO GROUP).

Variation 1° 50' to 2° 5' Easterly in 1887.

THE SUMATRA COAST.

PULO RONDO,* or Tepurong, is the northernmost of the islands lying off Achi head, the north-west point of Sumatra, distant about 30 miles. The island is 426 feet high, dark-coloured, 2 cables in diameter, and steep-to; rocky islets from 60 to 120 feet high extend to the distance of one mile from its south side.

PULO BRASSE, north-west end, lying 20 miles S. by W. $\frac{1}{2}$ W. from Pulo Rondo, is the westernmost of the islands off Achi head; it is $9\frac{1}{2}$ miles long in a north-west and south-east direction, high and level. Off the north end are four rocky islets, the northern (N.W. islet) is 25 feet high and about $3\frac{1}{2}$ miles distant, with soundings of 25 to 28 fathoms within one mile. The other islets lie within $1\frac{1}{4}$ miles of Pulo Brasse, and the sea breaks heavily on them even in moderate weather. There is a passage between the N.W. islet and the three inner islets, but vessels are recommended to pass outside.

Soundings of 15 to 20 fathoms, sand, will be found within one mile of the north-east and south sides of Pulo Brasse, where vessels may occasionally anchor.

Fleurs rock, a small rock having a depth of about 6 feet, lies about $1\frac{1}{2}$ miles from the west point of Pulo Brasse, and nearly in line with two small rocks above water, off the north point of that island. The water in the vicinity of the rock is discoloured, and breaks when there is any wind.

LIGHTS.—On the north-east point of Pulo Brasse stands a tower, 120 feet high, painted white to a height of 98 feet and red the remainder; from it is exhibited at an elevation of 525 feet above the sea a *revolving*

* See Admiralty chart, No. 219, Achi head to Diamond point.—Remarks on the Sumatra coast from China Sea Directory, Vol. 1.

white light which attains its greatest brilliancy *every minute*; the light is visible between the bearings of E. $\frac{3}{4}$ N. (through south and west) to N.W. $\frac{1}{2}$ W. and in clear weather should be seen from a distance of 30 miles; within a distance of 12 miles a faint continuous light is seen. North-eastward of Pulo Wai, the light is obscured by that island.

From the same tower, at a height of 26 feet above the ground, and 430 feet above the sea, is exhibited a *fixed red* light, visible between the bearings of S. by E. $\frac{1}{2}$ E. and E. by N. $\frac{1}{2}$ N. or over North-west islet; this red light is intended to warn vessels of their approach to North-west islet, and in clear weather should be visible from a distance of 8 to 12 miles.

Lembalei bay, on the north-east side of Pulo Brasse, is about $1\frac{1}{2}$ miles broad, half a mile deep, and has 19 fathoms water in the entrance, thence shoaling gradually to the shore. There is anchorage in the north-west part in 9 fathoms, 3 cables distant from the village.*

Coal may be obtained here from the Dutch Government depôt. It is brought alongside in lighters. During the north-east monsoon a heavy sea sometimes sets into the bay, which renders it doubtful as to the time a vessel may have to wait to fill up with coal.

PULO NANJI (Nassie), nearly joins the south-east point of Pulo Brasse, being separated by a narrow rocky channel of irregular depth, in which the tides run with great strength. Pulo Nanci is saddle-shaped, and about 4 miles long north and south. About one mile S.S.W. from the south-west point is a rock which breaks at half tide, and between the rock and the shore there are depths of 10 to 12 fathoms, outside there is 16 fathoms. From the rock, the south extreme of Middle island is in line with the northern of the small islets south of Middle island, bearing W.N.W. About $2\frac{1}{2}$ miles eastward of this rock and about half-a-mile off shore is a rock of 3 feet depth, with 6 and 8 fathoms close-to. From the 3 feet rock, the south extreme of the islet off the west end of Stony islet, is in line with a red mark in the cliff near King point. The south-east point of Pulo Nanci is skirted by rocks.

There is anchorage in 6 or 7 fathoms in the bay on the south side of Pulo Nanci island, about one mile eastward of the west point. Fresh water and firewood may be procured on the west side of the bay.

Rots bay, on the north-east side of Pulo Nanci, is about 4 cables broad and 4 cables deep. Off the south point of the bay is Rots island, small and nearly circular. There is anchorage in Rots bay in 6 fathoms at 3 cables from the shore.†

Middle island, or Pulo Nassie Kechil, lies off the south side of Pulo Brasse, between the latter and Pulo Nanci; off the south side of

* See plan on Admiralty chart, No. 219; scale, $m = 3$ inches.

† See plan on Admiralty chart, No. 219; scale, $m = 3$ inches.

Middle island, one mile distant, is a group of small islets, with from 9 to 12 fathoms water between them and Pulo Nanci.

Pulo Gomez (Klappa) is about 2 miles in length, and lies between Cedar and Surat passages. Its western point is low, and breakers extend about half-a-mile to the westward of it. The south side of Pulo Gomez is safe to approach.

Cedar passage (**Sawang Harus Besar**) is formed between Pulo Nanci island on the north, and Pulo Gomez (or Klappa) and Stony island on the south. The channel which lies to the southward of the rocks off Pulo Nanci is about one mile wide at its narrowest part, and has from 15 to 20 fathoms water.

Cedar passage is much wider than Surat passage, more free from eddies, and safer for a vessel proceeding to the westward with a foul wind, as she can drift with the tide under sail, taking care to avoid the rocks off Pulo Nanci. Stony island may be approached on its north-west side to within a quarter of a cable.

A patch of $4\frac{1}{2}$ fathoms lies midway between Stony island and Pulo Gomez.*

SURAT PASSAGE (**Sawang Harus Kechil**) is formed by Pulo Gomez, Stony island, and Pulo Angkasa on the north-west, and the promontory of Achi on the south-east. Between Pulo Angkasa and Achi head at the eastern end, the passage is only 150 yards wide, but has from 12 to 14 fathoms water. Between Pulo Gomez and the mainland the passage is $1\frac{1}{2}$ miles wide, with 12 to 16 fathoms water. Near the east side of Pulo Gomez there is a rock one cable distant from the shore.†

Directions.—In approaching Surat passage from the south-west no opening is perceived, the adjacent islands Gomez, Nanci, and Brasse appearing to join the mainland when seen from that direction. South-eastward of King point, at the distance of 5 miles, and on the south side of a low green point, there is a sandy bay named Krang Baba, which at a considerable distance may be mistaken for Surat passage, the adjacent land being low near the sea, and covered with trees.

Steering for Surat passage, vessels should keep nearer to Achi head than to the opposite side of the channel, as Achi head is bold, with regular soundings of 12 to 14 fathoms, sand, at a moderate distance, and temporary anchorage may be found near the shore in from 7 to 10 fathoms. The south side of Pulo Gomez island is also safe to approach, there being

* The rocky patch of 4 fathoms formerly shown on the charts, situated W. by S. 8 miles from the west end of Pulo Gomez island, and the narrow ridge of soundings of 7 to 10 fathoms (possibly less), reported to extend 40 miles in a S. by E. $\frac{1}{2}$ E. direction from it, are said to have no existence.

† See also plan of Surat passage on Admiralty chart, No. 2,760.

18 fathoms within half a mile of its south point. If the tide be unfavourable, a vessel should anchor near Achi head until the flood stream makes; the flood sets north-eastward, directly through the passage, the ebb in the opposite direction at the rate of 5 to 7 miles an hour at springs in the narrowest part of the passage; the eddies caused by the rapid tides, render steering in this part very difficult for sailing vessels during light winds, and for large vessels it is attended with some risk.

PULO WAI, the north-easternmost and largest of the islands off Achi head, lies about 13 miles north-east of the head, and 10 miles south-east of Pulo Rondo. Pulo Wai is about 11 miles long, from 2 to 6 miles broad, and mountainous; the summit being 1,360 feet above the sea, may be seen from a distance of 36 miles in clear weather. Its south side is steep to in most places, there being no change in colour from the deep ocean blue of the water at 2 cables from the shore, but at other parts of the south side there are soundings near the shore. Berduri rock, dry at low water, lies about half a mile distant from the south point; the ground is apparently foul between.

In Balohan bay, about one mile deep, on the south-east side of Pulo Wai there are depths of 20 to 60 fathoms, sand, where possibly anchorage may be obtained. Fresh water may be procured at the head of the bay near a sandy beach. There is a sulphur mine in the vicinity.

Pulo Wai is under cultivation, and there are said to be 300 or 400 inhabitants on the island.

Coal.—In Prialaut bay on the north side of the island, there is a land locked harbour, with anchorage in 12 fathoms. It is proposed to establish a coaling station there.*

Pulo Wai is under cultivation, and there are said to be 300 or 400 inhabitants on the island.

BENGAL PASSAGE, formed between Pulo Brasse and Pulo Wai, is about 11 miles wide, and convenient for vessels sailing from Achi head to the north-westward, as the current generally sets out in that direction, but vessels bound into Achi road seldom proceed through Bengal passage unless with a steady commanding breeze, there being no anchorage in the passage except near Pulo Brasse. During the south-west monsoon, the current sets round Pulo Brasse to the westward, frequently at the rate of one to 2 miles an hour.

ACHI (ACHEEN) HEAD is a bluff promontory 1675 feet high, forming the north-west extremity of Sumatra. At a considerable distance Achi head appears like a steep hill, Pulo Gomez then

* Navigating Lieutenant Pritchard, H.M.S. *Fly*, 1888.

resembles two paps, its western point being very low. King point (Ujong Rajah) is the south-west extremity of the promontory of Achi head, and lies about 3 miles to the south-west of the head.

Tides.—It is high water, full and change, at Achi head at 10h.; springs rise 5 feet, neaps $3\frac{1}{2}$ feet.

ACHI (ACHEEN) BAY and RIVER.—Achi bay is formed between the eastern part of Achi head and the entrance of Achi river. The shores are low, wooded, and skirted by a bank, on which depths of 5 fathoms are found at about 5 cables from the shore. In the western part of the bay is Pulo Tuan, a small island joined to Achi head by a rocky ridge 6 cables long.* It is contemplated to connect Pulo Tuan with the shore by a causeway, to form a harbour for Oléhleh.

Achi river falls into the sea by several mouths, separating the low country into islands, which are inundated during the rainy season. The principal mouth, which is situated about 5 miles to the eastward of Achi head, is about 100 yards wide, and has a depth of one foot on the bar at low water, and 6 feet at high water. There is a pyramid beacon on the west point of entrance to Achi river, and a remarkable tree on the shore at $1\frac{1}{2}$ miles eastward of the flagstaff at Oléhleh.

Anchorage.—The usual anchorage is off the town of Oléhleh, in from $4\frac{1}{2}$ to 5 fathoms, at about half a mile off shore. The holding ground is bad.

The anchorage off Achi river is in from 7 to 9 fathoms with the entrance bearing S. $\frac{1}{2}$ E. to S.S.E. distant one mile. During the south-west monsoon, which prevails from May to October, a good scope of cable is necessary in these anchorages, as the squalls are severe. During the north-east monsoon the winds are seldom strong, but north-west winds sometimes blow with great force through Bengal passage, and render the anchorage insecure. Land and sea breezes often blow during both seasons, but the land breezes do not extend beyond the islands. The bay is infested with sharks.

TOWNS.—Kotta Rajah, the Dutch capital of Achi, is situated on both banks of Achi river, connected by a wooden bridge, about 3 miles from the entrance. The Dutch Governor resides here.

Oléhleh, situated on the shore of Achi bay, is connected with Kotta Rajah by a railway $3\frac{1}{2}$ miles in length, and which further extends to Lambaru, the Dutch advanced post, 3 miles beyond Kotta Rajah. The British Consul resides at Oléhleh. There are three landing piers.

Coal.—There is no coal at Oléhleh, but it may be obtained from the Government dépôt at Lembalei bay, Pulo Brasse, about 15 miles distant.

* See plan of Achi bay and river on Admiralty chart, No. 219; scale, $m = 2$ inches.

Supplies.—Fresh beef, poultry, vegetables, bread and water, are to be obtained, and fruit when in season.

Trade.—The exports are pepper, betel nuts, gutta percha, and other gums, rattans and cocoa-nuts. The imports are cattle (from India), haberdashery, and all descriptions of provisions. Most of the exports and imports on the north coast are collected and distributed at Oléhleh. In 1883, the exports, principally pepper and betel nuts, amounted to 31,000*l.*; the imports to 265,000*l.*, a large portion of the latter being for the Dutch troops stationed there.

Shipping.—In 1884, 189 Dutch steamers visited Oléhleh, and 14 English; 19 sailing vessels also entered and cleared.

For 1883, the number of English steamers was 130; the falling off being caused by an order to convey all Government goods in Dutch vessels. A monthly steamer has taken the place of the former weekly one to Penang.

MALACCA PASSAGE, formed between Pulo Wai and the Sumatra coast, is 7 miles broad, and the best channel when approaching Achi from the northward.

Pulo Buru (Malor), is situated in Malacca passage at about $2\frac{1}{2}$ miles from the Sumatra shore. The islet is fringed by a reef to the distance of about 3 cables, beyond which there are no dangers.

LIGHT.—A *fixed* white light is exhibited on Pulo Buru from an iron standard 62 feet above high water, visible in clear weather from a distance of 10 miles.

PEDRO POINT (Tanjong Batu), the north point of Sumatra, is situated 13 miles E.N.E. from Achi head, and may be approached to a depth of 9 or 10 fathoms at the distance of one mile. The point is low, terminating in a green slope with a few trees, and is fringed by a rocky shoal which extends a quarter of a mile seaward. A bluff formed by high land is situated $1\frac{1}{2}$ miles westward of Pedro point. The bottom in this vicinity is rocky, and the soundings do not extend more than $1\frac{1}{2}$ or 2 miles from the shore.

During the months of December, February, and part of March, the weather is generally fine, with little or no rain, the winds varying from N.E. to E.S.E. and S.E., and the thermometer varying from 79° to 82°. It may generally be remarked, during this season, that if the canoes are not seen out fishing before 7 or 8 a.m. that a fresh breeze may be expected during the day.

BETWEEN PULO RONDO and GREAT NICOBAR ISLAND (the southern of the Nicobar group), is a channel about 90 miles wide, free from danger, in which are depths varying from 990 to 405 fathoms, decreasing towards the Nicobar island side.

NICOBAR ISLANDS.

About 90 miles north-west of Sumatra and south of the Andaman islands, or between lat. $6^{\circ} 40'$ and $9^{\circ} 20' N.$, and long. $92\frac{1}{2}^{\circ}$ and $94^{\circ} E.$ the Nicobar islands extend in a N.N.W. direction. This group consists of 8 large and 12 small islands, of which the following are the principal, Great Nicobar, Little Nicobar, Katchall, Nankauri, Karmorta, Trinkut, Terressa, Tillangchong, Bompoka, Chauri, Batti Malve, and Kar Nicobar. Many of the channels which separate the islands form excellent and safe passages for ships. Most of the islands are hilly, and some of the peaks attain a considerable height. Others again are flat and covered with cocoa-nut trees. All of them are well wooded. The valleys and sides of the hills, to a considerable height, are so thickly covered with trees that the light of the sun is not able to penetrate through their foliage.*

“With but few exceptions the shores of the islands consist of coral sand, or are fringed with coral banks extending seaward to a depth of 30 fathoms. In like manner the bays appear edged with coral reef, if not actually studded with reefs. The promontories frequently present cliffs above and below water, extending a couple of miles into the sea, which, owing to the occasional rapid currents and light breezes, are not always easily weathered.”†

From 1846 to 1858 the Nicobar islands belonged to Denmark, but were given up in the latter year. In 1869 they were annexed by H.M. Indian Government and placed under the Superintendent of the Andaman islands. The chief harbour is that of Nankauri in the island of the same name.

Population amounts to about 6,000 persons. The natives are copper coloured rather short in stature, with Chinese eyes, small flat noses and straight black hair. Fishing forms their chief occupation, and their food consists of pigs, poultry, turtle, fish, cocoa-nuts, yams, and a bread made from the fruit of the *mellori* tree.

* Nav. Lieutenant E. D. Philips, H.M.S. *Wasp*, remarks “With the exception of Trinkut, the whole of these islands are hilly and generally wooded to the water’s edge. In some places the hills are clothed with a long coarse grass called ‘lallong,’ of a brilliant green colour, which gives the land a different appearance to places we are in the habit of seeing in these latitudes. The natives are extremely ugly, their teeth are jet black from chewing the betel nut, and protrude far beyond the lower lip; their hair hangs about their shoulders, and their dress, a narrow strip of cloth, is allowed to hang down behind, forming a tail. A superior being is recognised, termed Hautau (devil), thought to have power for harm, but incapable of doing a good action. The natives are treacherous in the extreme. Water of very inferior quality can be procured, and pigs and fowls to a limited extent. Wood for steam vessels could be cut to any amount.”

† Voyage of Austrian I. F. *Novara*, 1858.

U 18387.

Natives.—The islanders as a rule are said to be cowardly and treacherous. They have committed repeated murders in former years on the crews of vessels. There seems little doubt that many vessels supposed to have been lost in the bay of Bengal, have been cut off and plundered by the natives of the Nicobar islands. Their villages are generally built upon the beach, and consist of 15 or 20 houses, raised upon wooden pillars about 10 feet from the ground, they are round, and having no windows resemble bee hives covered with thatch, the entry being by ladder through a trap door. Each house contains about 20 people.

There is no written language, and the dialects spoken differ so much that the inhabitants of one island can scarcely make themselves understood in another.

Products.—The soil is nowhere cultivated. The principal product is the cocoa-nut palm, and its ripe nuts the chief export. Edible birds' nests, tortoise shell, ambergris, and trepang (sea slug) are also exported. The number of English and Malay vessels that trade to the Nicobar islands, is said to be increasing. In barter are used black, blue, and red cloths, handkerchiefs, cutlasses, Burmese *dáos*, spoons, spirits, tobacco, red woollen caps, &c.

CLIMATE.—Owing to the dense jungles the climate of the Nicobar islands is unhealthy, the prevailing disease being malarious fever. The heavy rains occur in May, June, July, when the south-west monsoon is at its height, but even the driest months from December to March are not without rain; the annual rainfall being estimated at 100 inches.* The seasons of the monsoons are not so well defined amongst the Nicobar islands as on the coasts of the bay of Bengal generally.†

WINDS.—The prevailing winds amongst the Nicobar islands, are the monsoons, the north-east from November to March, the south-west from May to September. During April and October there are variable winds and calms, extending more or less into the adjoining months. The hurricanes of the bay of Bengal seldom visit the Nicobars; they seem to originate nearer the Andaman islands, or towards the west coast of Sumatra, proceeding in the former case towards the northern portions of the bay, and in the latter towards the Coromandel coast and Ceylon. During

* July 23rd to August 10th, scarcely a day has passed without heavy squalls, accompanied with pouring rain. Average barometer, 29·90 in., thermometer, 84°.—(Nav Lieut. E. D. Phillips, H.M.S. *Wasp*, 1867).

† The climate, though tropical, is not to be ranked among the hottest, in consequence of the insular position of the archipelago, and of the whole of the islands being covered with forest, hence the rainfall is sufficient to keep the rivers full, even in the dry season. The average temperature does not exceed 77°, but during April and October, at which period calms prevail, the maximum temperature of 86° to 88° is reached. March is the driest month in the year.—(Voyage of the *Novara*. 1858).

the south-west monsoon, frequent thunderstorms and gales of wind occur, especially in the vicinity of Great Nicobar island. The north-east monsoon brings fine weather, and sometimes blows with considerable strength.

TIDES and CURRENTS.*—In the immediate neighbourhood of Nicobar islands a vessel will probably be influenced by the tides, the flood setting to the north-east and ebb to the south-west. In the offing the surface drift is affected by the prevailing monsoon, but is uncertain in strength, and irregular in direction. Between the Nicobar islands and Junkseylon, a strong north-west current has at times been experienced, sometimes setting north. On the other hand, between Great Nicobar island and Achi head of Sumatra, H.M.S. *Rifleman* in August 1878 experienced a S.W. set of 2 knots an hour, the wind at the time being S.E. force 2 to 3.† In February 1882, H.M.S. *Alert* experienced a current to the westward between Great Nicobar island and the north coast of Sumatra of as much as 59 miles in the 24 hours.

Tide rips.—The Austrian I. F. *Novara* found that in these waters occurs a belt within which the surface currents meet. The sea here appears in a state of ebullition, and makes a considerable noise without there being anything to indicate an increased strength of current, on the contrary the velocity appeared diminished. This phenomenon may be attributed to partial tide currents crossing each other's course, or opposing each other, as also to certain conditions of temperature at various depths.

The time of high water, full and change, at Kar Nicobar occurs at 9h. 40m., at Diamond point in Sumatra at 12h., and at the entrance to Malacca strait at 5h. 30m. The rise of tide at Kar Nicobar is 5 feet, at Diamond point 9 feet, and at the entrance to Malacca strait 15 feet, clearly denoting tidal irregularities, which may assist to account for the frequent tide rips met with. Nav. Lieut. W. H. Petley, R.N., H.M.S. *Alert*, February 1882, remarks, "From Pulo Pera in Malacca Strait to the Nicobars, we passed through lines of heavy overfalls, about 3 to 5 miles apart; these occasionally had the appearance of breakers upon the weather side of a reef."

GREAT NICOBAR (Sambelong)‡ is the southernmost and the largest of the islands of the Nicobar group, extending for about 30 miles north and south, with a breadth of from 7 to 14 miles. The highest part

* The flood stream comes from the S.W. and the ebb from the N.E., but among the islands its direction varies with the passages between them. While at anchor to the southward of Kar Nicobar, two days after full moon, we found the stream running $3\frac{1}{2}$ miles an hour; and north of Little Nicobar, near the small island of Treis, two days after new moon, its velocity was $4\frac{1}{2}$ miles an hour.—(*Novara*, 1857–9).

† Remark Book of Nav. Lieutenant of H.M.S. *Rifleman*, 1878.

‡ See Admiralty chart, Nicobar islands, No. 840.

of the island is that to the north where the highest mountain attains an altitude of 2,111 feet, and is visible in clear weather from a distance of about 35 miles. Near the centre a range of hills 1,333 feet high, extends in an E.N.E. direction across the island. To the southward, there is more high land, but not so much elevated. Almost the whole island is thickly covered with trees, and the soil is of great fertility. The western side of the island, exposed to the full bent of the south-west monsoon, has not been examined. The natives of the interior are believed to be a different race to those of the coast.

South bay* (Galathea) at the south end of Great Nicobar island is an indentation 2 or 3 miles in extent, where there is fair anchorage during the north-east monsoon in from 9 to 16 fathoms; but its salubrity cannot be recommended, as owing to the position and shape of the bay it is excessively hot. A small river, navigable for a considerable distance by boats, empties itself into the head of the bay, but a sand bar closes its mouth at low water.

Upon passing the south, or Parsons point, off which the surf breaks heavily, a remarkably flat island named Walker, resembling a fort with sentries posted round, will be seen on the west side of the bay, about 9 cables northward of Parsons point. The only landing place bears from Walker island, N.E. by E. $\frac{1}{2}$ E. and is on coral slightly fringed with sand, between two reefs, and even then the aid of canoes is necessary.

Anchorage.—H.M.S. *Dryad* in January 1871 anchored in $12\frac{3}{4}$ fathoms in South bay with the following bearings:—Hayward or S.E. point S. 77° E., Walker island S. 60° W., Parsons or South point S. 46° W. A flagstaff was erected, which bore from Walker island S.W. by W. $\frac{1}{2}$ W.; at the same time the island was formally taken possession of.†

The East Coast of Great Nicobar island northward of South bay, is imperfectly known; it appears indented in parts, and probably contains anchorages available during the south-west monsoon, when smooth water will be found on this side of the island. At about 12 miles northward of South bay, and 2 miles from the shore, is Boat rock, with three smaller rocks to the south-west of it, in the approach to a deep bight.

Trinkut Champlong bay‡ is small, and situated about a mile from the extreme north-east point of Great Nicobar island. It affords a safe anchorage in the south-west monsoon in from 10 to 7 fathoms, half a mile off shore. On entering the bay the water shoals suddenly from 22 to 10 fathoms, but thence to the shore the soundings decrease regularly. A vessel should not go nearer to the shore than in 6 fathoms. Great Nicobar

* See plan of South bay, scale, $m = 1.27$ inches on Admiralty chart, No. 840.

† Remark Book of Commander George Parsons, H.M.S. *Dryad*, 1871.

‡ Remark Book of Nav. Lieutenant E. D. Phillips, H.M.S. *Wasp*, 1867.

island on this, the east side, is hilly and wooded to the water's edge. H.M.S. *Wasp* anchored in 7 fathoms with the centre of village bearing West, and the outer points of the bay, North, and S. 13° E.

Ganges harbour on the west side of the north-east point of Great Nicobar island, affords anchorage in from 9 to 16 fathoms, coarse sand and clay. In the entrance to the harbour is a 4-fathom bank, forming a middle ground, upon which are two rocks about 3 feet under water. Shoal water extends nearly a mile to the westward from the eastern entrance point of the harbour. On each side of the middle ground, in the entrance leading into the harbour, are depths of 17 and 27 fathoms.

Kondul harbour.*—Westward of Ganges harbour and near the north-west point of Great Nicobar island, is Kondul harbour, protected to the northward by Kondul island, a rocky islet 2 miles in length, N.N.W. and S.S.E., with a hill near its centre, 400 feet high. Though the north side of this island is lofty and rocky, the east side affords secure landing. Vessels anchor here in 12 to 17 fathoms, sand and coral, at about midway between the island and the shore; or, they may anchor off the west side of the island in 10 to 12 fathoms, in each case selecting a position according to the direction of the prevailing wind. The anchorage of Kondul is landlocked towards both north-east and south-west, besides having the additional advantage of being airy, and distant from the mangrove swamps, whereas in the bays on the north coast of Great Nicobar, these are of immense extent.

The shores of Great Nicobar and of Kondul island should not be approached too closely, as other rocks may exist besides those shown on the chart. The soundings around Great Nicobar island are scarce, nor has the west coast been examined.† An island about a mile in length lies near the western shore in about lat. 6° 58' N. At 5 miles south-west of Kondul harbour are depths of 7 and 8 fathoms, and 30 fathoms is shown to exist 8 miles westward of the western coast, with soundings of 13, 18, and 23 fathoms scattered near. The edge of the plateau on which the island of Great Nicobar stands, and which apparently extends a considerable distance from its coast, has not been determined.

St. George Channel separates Great and Little Nicobar islands, and carries depths of 50 and 60 fathoms; but the tides which set fair in the direction of the channel, the flood to the north-east, are strong, and

* See plan of St. George's channel and Kondul harbour, on Admiralty chart, No. 840, scale, $m = 0.6$ inches.

† On the west side of Great Nicobar, along which we sailed, but could not visit more carefully owing to want of time, and the heavy south-west swell, are several promontories, and coves apparently available as harbours, which may moreover be the embouchures of rivers.—(Voyage of *Novara*, 1858.)

it is seldom used by strangers. At the eastern entrance to the channel, and about $2\frac{1}{2}$ miles N.N.E. of the north-east point of Great Nicobar island is Kabra islet, which is small with deep water on either side of it. St. George channel narrows in its western mouth; Kondul island, is here situated, reducing the breadth of the channel north of it, which is generally used, to less than 2 miles.

LITTLE NICOBAR ISLAND is 12 miles in length by about 8 miles in breadth, narrowing considerably towards its northern part. It is broken up into hilly ranges, the highest of which, the southern, rises to an elevation at its eastern end of 1,175 feet, and at its western end to 991 feet. The whole island is thickly covered with swamp and forest. About a mile from its eastern side, and separated by a channel having a depth of 21 fathoms, is the small island of Montehall, about 2 miles in length north-east and south-west.

Meroc islet, which is low, and about a mile in length north-east and south-west, bears W.N.W., distant 10 miles from the north point of Little Nicobar island, and the islets of Treis and Trak are distant respectively 3 miles and $4\frac{1}{2}$ miles from the same point, in about the same direction. There are sunken rocks near Treis and Trak islets; and midway between Treis, which has reef extending off it for a quarter of a mile, and the north point of Little Nicobar island, is a rock, having over it less than 6 feet of water. On the islet of Treis, pigeons were found in great variety, and also traces of brown coal, but hardly suitable for domestic use, by the scientific staff of the *Novara*.*

Pulo Milú† is an island off the north-west coast of Little Nicobar island, about three-quarters of a mile in length, north and south, by 4 cables in width. The channel eastward of Pulo Milú, or between it and Little Nicobar island, about 4 cables wide, forms a harbour, shaped almost at a right angle, with depths varying from 9 to 13 fathoms, bottom sand and coral. This anchorage is accessible in all winds, and is well sheltered, but a considerable portion adjoining the shore of Little Nicobar, is rendered useless by banks of coral. No water fit for drinking could be found by the *Novara*. The island of Pulo Milú, on which the screw pine grows in exceptional size and quantity, affords good landing on its eastern side.‡ The natives are reported to be inoffensive and willing to trade, but are very poor, owing, probably, to the cocoa-palm not growing so luxuriantly here as on Kar Nicobar and other islands of the group.

* The *Novara* anchored about a mile north of Treis island; the strength of the stream of the tide here being estimated to run as much as 5 knots an hour at springs.

† See plan of Pulo Milú, scale, $m = 2.4$ inches, on Admiralty chart, No. 840.

‡ Next to Kar Nicobar, Pulo Milú was considered the most suitable spot for a first settlement.—(*Novara's* voyage, Vol. 2, p. 66.)

SOMBRERO CHANNEL, about 30 miles in width, separates Little Nicobar island from the islands of Katchall and Nankauri. In it are the islets of Meroe, Treis, and Trak already described. The depths in the southern part of the Sombrero channel are irregular, varying from about 50 to as much as 520 fathoms. A detached coral bank, with from 9 to 16 fathoms on it, is situated in the northern part of Sombrero channel, covering a space of about 7 miles in length, N.N.E. and S.S.W., by 4 miles in width. The tides set strongly in the Sombrero channel, N.W. and S.E., and are said to attain in parts, a velocity of as much as 5 knots at springs.

KATCHALL ISLAND bears N.N.W. from Little Nicobar, the distance between their two nearest points being 33 miles. It is an island irregular in shape, about 13 miles in length N.W. and S.E., by from 8 to $2\frac{1}{2}$ miles in width. Deep bays indent its eastern and western sides, being most extensive on the former. The island is long and low, without any marked elevation, but of sufficient height to be visible from a distance of about 15 miles, the northern and western parts being least elevated. It is covered with forest to the water's edge, and furnishes cocoa-nuts, ambergris, tortoise-shell, and edible bird's nests.

Anchorage on the south-west side of Katchall island may be obtained in about 11 fathoms, off the entrance of the lagoon-like indentation on that side, but of an exposed nature. About 8 miles south-west of this anchorage is a depth of 12 fathoms, yellow clay, and other shoal ground may exist in the neighbourhood.

Anchorage in a bay on the east side of Katchall island, was visited by H.M.S. *Wasp* in July 1869. "This bay has a reef extending across the entrance from the North to the South points, with, in places, only 4 fathoms over it. This reef is steep-to on both sides; on the outer falling from 4 fathoms to 25 fathoms, no bottom, and on the inner to 23 fathoms. After crossing the reef, on steering into the bay, the depths gradually decrease. The holding ground is indifferent, and the anchorage open to the north-east monsoon. The whole bay seems to be dotted with rocky patches, and not a desirable place to remain in for any time. The best anchorage in 10 fathoms, sand and rock, is with the following marks, North point $N. 11^{\circ} E.$, South point $S. 86^{\circ} E.$ "

Foul ground extends from the south point of Katchall island for about a mile, and a depth of 2 fathoms is shown, half a mile from the shore, 2 miles north-westward of the same point.

The channel between Katchall and Karmorta and Nankauri islands, is from 3 to 5 miles in width, from 28 to 135 fathoms in depth, and free from danger.*

* There we made short tacks in passing through, approaching the shore on either side within half a mile.—(*Nevara's Voyage*, Vol. 2, p. 86.)

KARMORTA ISLAND, the south coast of which forms the north side of Nankauri harbour, is 15 miles in length, north and south, by from 8 miles to half a mile in width. The northern and middle parts of this island are of moderate height, the hills being flat-topped, the south-eastern part, which is the highest, rising to an elevation of 200 feet; it is here that the principal village is situated. On both sides of the island, villages and huts are sprinkled along the shore, and although the vegetation is rank, Karmorta bears a picturesque aspect, consequent on the alternations of forest and grass slopes, with the white coral beach crowned with cocoa-palms.

Ulala Bay.*—On the western side of Karmorta island, $2\frac{3}{4}$ miles northward of its south point, is the entrance to Ulala bay, a considerable land-locked bight, which runs in an easterly direction parallel to Nankauri harbour, from which it is separated by a low, narrow, irregular, peninsula. The numerous mangrove swamps render Ulala bay an undesirable place to remain in for any length of time, and fresh water is scarce in quantity, and of doubtful quality.

The western part of Ulala bay, known as Ho-hoa, or Expedition harbour,† was visited by H.M.S. *Wasp* in 1869, and it was remarked that "The bay should be approached with extreme caution, more especially from the northward, as in that direction are several outlying dangers which only show at low water. The passage in, about half a cable wide, is close to the south shore, but carries deep water. Do not attempt to enter until Edgumbe point bears N. 54° E., when steer in on that bearing, passing Satellite point at the distance of a cable, and when Devil point bears North, steer for it, and anchor as convenient to the south of that point, in about 12 fathoms, soft mud."

There are no other known anchorages on the shores of Karmorta island, except Nankauri harbour, hereafter alluded to. From the north-west point of the island, Perseus reef extends for nearly 3 miles in a north-west direction; in this vicinity is the village of Kaihul.

TRINKUT, singularly low and level, and abounding in cocoa palms, is $7\frac{1}{2}$ miles in length, north and south, by about 2 miles in width. Near the centre, the island is nearly split in two by a deep indentation, the opening of which, to the westward, has been named Erith inlet. The village of Dschanoha lies near the head of this inlet. The channel between Trinkut and Karmorta is about a mile wide, but so far as is known

* See Ulala bay on Admiralty plan of Nankauri harbour, No. 841, scale, $m = 3.2$ inches.

† "On no account should a vessel go beyond Edgumbe and Devil points without having the Middle reef and long coral spit northward of it buoyed. A small supply of fresh water may be had at the rivulet marked on the chart near *Wasp* point."—(Nav. Lieut. J. G. Connell, H.M.S. *Satellite*, 1869.)

is almost blocked by Eleanor bank, a large sunken sand bank, with irregular soundings over it and patches of rock. Vessels sometimes anchor in from 8 to 9 fathoms between the north point of Trinkut and the coast of Karmorta, but local knowledge would appear necessary, this part abounding in patches of coral rock.

False bay on the south-west side of Trinkut, is formed on the east side by the shore of that island, and on the west and south-west by the eastern coasts of Karmorta and Nankauri islands. On the north and south False bay is protected by the coast reefs, which effectually prevent any heavy swell. Vessels should not lie with too short a scope of cable, as at times the squalls off the land are very heavy; the holding ground is good. H.M.S. *Wasp* anchored with Red and White cliff point, bearing S. 70° W., south visible extreme of Nankauri S. 30° E., south end of Trinkut S. 80° E., in 10 fathoms, sand and mud.*

NANKAURI ISLAND, the north coast of which forms the south shore of the harbour of the same name, is 5½ miles in length, north and south, with an extreme breadth of 4½ miles. It is high thickly wooded, and has but few inhabitants; off the south point a reef of rocks extends for about a mile to the southward, visible at low water.†

Nankauri harbour, formed between the islands of Karmorta and Nankauri, is 3½ miles in length east and west, and in parts about 2 miles in width; it is commodious and sheltered from all winds. Having two entrances, one from the east, and the other from the west, it can be entered or left without difficulty, in either monsoon. In 1869, Nankauri was made a penal settlement, subordinate to port Blair of the Andaman islands. Supplies for the convict establishment and officers are brought from Calcutta. The town is on the north side of the harbour, where also there is a wooden landing pier 700 feet in length.

The climate is sultry and relaxing, the thermometer standing at from 84° to 86°; the proximity to the mangrove swamps render a long stay undesirable from a sanitary point of view, the heat occasionally is said to be overpowering.‡ The western entrance is about a cable in width, and though narrower than the eastern, has the advantage of all dangers being visible.

Buoys.—The eastern entrance is marked by two buoys; a red conical buoy in 6½ fathoms, marks the north-east extreme of the reef off the village of Alla Koang, and a black conical buoy is placed outside the southern edge of the reef extending off Naval point. There is also a red mooring

* Remark Book of Nav. Lieut. E. D. Phillips, H.M.S. *Wasp*, 1869.

† Remark Book of Commander George Parsons, H.M.S. *Dryad*, 1871.

‡ Voyage of *Novara*, 1858.

buoy for the mail steamers, bearing W.S.W. of Naval point, distant $2\frac{3}{4}$ cables.

DIRECTIONS.—Western Entrance.—In coming from the southward and westward, the western entrance is not easily distinguished until abreast of it. With the south-east point of Katchall island bearing N. by E., mount Edgicumbe, the highest and southern part of Karmorta island forming the north side of the entrance to the harbour, will be seen in the same direction. Upon opening mount Edgicumbe, the south side of the entrance is marked by a detached rock, resembling a dog's head, having steep sides and a bushy top, with rocks apparently extending off it. Care must be taken in a sailing vessel, that the tide does not take the vessel on either bow when entering. A vessel should pass midway between Indian and Man points, then steer N.E. by N. up the harbour, edging to the northward as point Leda is approached, until Naval point bears E.N.E., when the latter may be steered for. This will lead midway between the reefs off Alfred and Leda points, and up to the anchorage off the settlement, which latter is on the Karmorta side, between Naval and Battery points.

Eastern entrance is considered easier than the western, on account of its greater width. Buoys mark the shoal water off Reid and Naval points. The narrowest part of this entrance is between the reefs immediately south of Naval point. The depth in the channel here is about 20 fathoms. Outside, to the eastward, the water shoals again, but the depth outside the reefs is never less than 6 fathoms.

ANCHORAGES, Inner.—Nankauri harbour inside, opens out into four considerable bights, the two to the north known as Fort or Octavia, and Satellite bays, the two to the south as Spiteful and Wasp bays.

Fort or Octavia bay, the easternmost of the northern bights alluded to, is clear and affords anchorage in its upper part in 11 fathoms.

Satellite bay is easy of entrance, but care should be taken if under sail to guard against the sudden changes of wind caused by the formation of the surrounding land. A detached patch of $2\frac{1}{4}$ fathoms, coral, with 5 fathoms around it, exists about 8 cables south-west of Alfred point. H.M.S. *Wasp* anchored with the following bearings:—Spit point S. 11° W., Alfred point N. 86° E., Mala point S. 85° E.

Wasp bay, the westernmost of the southern bights, is spacious and has general depths of from 18 to 21 fathoms with a detached patch of rocks which cover at high water, a little more than a mile S. by W. of Leda point, and distant 3 cables from the eastern shore.

Spiteful bay, the easternmost of the southern bights, is narrow and runs up in a S. by E. direction for $1\frac{1}{2}$ miles, terminating in an extensive mud bank, dry at half ebb. This bay should not be attempted by a

stranger unless the reefs have been previously buoyed. The most convenient anchorage is with Leda point bearing N. 80° W., Mala point N. 32° E. in $12\frac{1}{2}$ fathoms, sand and mud. This position is well open to the sea breeze.*

Outer anchorage.—During the south-west monsoon, vessels trading with Karmorta, Nankauri, and Trinkut, should anchor outside Nankauri harbour, or about midway between the eastern entrance and the south-west coast of Trinkut.

Tides.—It is high water, full and change, in Nankauri harbour, at 9h. 15m. Springs rise 8 to $8\frac{1}{2}$ feet. The flood tide sets to the eastward, ebb to the westward, and in the entrances, the stream attains considerable strength, though weak inside the harbour.

Supplies of pigs, fowls, yams, and cocoanuts, can be procured, and a small quantity of fresh water is procurable from a stream between Naval and Battery points.

TILLANGCHONG, about 8 miles in length, north and south, by less than a mile in width, is about 450 feet high, steep, and with a jagged ridge, the highest part of which is near the centre of the island, and bears N.N.E. $\frac{1}{4}$ E., distant $18\frac{1}{2}$ miles from the north point of Karmorta. Extending south-east from the south point of Tillangchong for the distance of $1\frac{1}{2}$ miles, is a chain of needle-like rocks, the highest of which, near the extremity, is termed Laouk. Tillangchong is visited occasionally by the natives from Chauri and Bompoka; the legend of its being a place of banishment for the natives of the other islands of the group being apparently unfounded.

Anchorage.—The *Novara* anchored on the west side of Tillangchong about 2 miles south of the north point, and by the same authority, the bay on the south-east side of the island affords excellent anchorage during the greater part of the year, but is exposed to the south-east.

TERRESSA is an island 12 miles in length, north-west and south-east by about $2\frac{1}{2}$ miles in width, and is distant about 12 miles to the north-west of Karmorta. It takes a curved shape, the outside part of the bend facing to the westward. From a distance it appears like two islands, the central part of the island being considerably lower than either the north or south part. Reefs extend from its north, west, and especially south-east parts, and it is not considered a desirable place to visit during the south-west monsoon. Anchorage may be had on its south-west side off a village called Henam, and also on the eastern side abreast the north point of Bompoka island, which lies contiguous to it; but the water is deep and the anchoring position near the shore, in either case. Terressa has but few inhabitants.

* Remark Book of Nav. Lieut. E. D. Phillips, R.N., H.M.S. *Wasp*, 1867.

BOMPOKA is an island $3\frac{1}{2}$ miles in length, north-west and south-east, by $1\frac{1}{2}$ miles in width, 750 feet high, and sparsely wooded. It is separated from the south-east part of Terressa by a channel, in which are soundings of 30 and 50 fathoms. The inhabitants are few, and the women of this island have been remarked to bear an improvement in appearance over those of the other islands of the Nicobar group.

CHAURI, an island $2\frac{1}{2}$ miles in extent, lies $4\frac{1}{2}$ miles north-west of the north point of Terressa. The island is generally low, but at its south end rises almost perpendicularly to a considerable height in a rocky pinnacle, having the appearance, with the contiguous low portion, of a flap hat. It was on this account termed *Sombrero* by the early Portuguese navigators, and the *Sombrero* channel, to the southward, between Little Nicobar and Katchall owes its name to it. A village, with indifferent anchorage off it, is situated on the east side of the island. Hogs, poultry, and tropical fruits are obtainable, probably in small quantity, and the natives are reported friendly to strangers. This is the only place in the Nicobar group where the manufacture of pottery is carried on.*

Reef extends to a distance of about $1\frac{1}{2}$ miles from the north and west sides of Chauri. The flood tide in the vicinity sets to the north-east, and ebb to the south-west.

Coral Bank.—To the north-west of Chauri island, and separated from the reef extending from its north-west side by a channel about $1\frac{1}{2}$ miles wide, in which is a depth of 9 fathoms, is a coral bank, on which are depths of from $1\frac{1}{2}$ to $2\frac{3}{4}$ fathoms. This coral bank occupies a space of about $2\frac{1}{2}$ miles in length, north-east and south-west, but its exact limits have not been properly determined.

BATTI MALVE is an island about 150 feet in height, and distant from Chauri about 24 miles on a N.N.W. bearing. It is small, of quadrangular form, the upper portion thickly wooded, and is without inhabitants. Towards the north-west part, Batti Malve becomes flattened near the coast, whereas on the west, south, and south-east sides, the rocks descend perpendicularly into the sea.† From a distance, this island resembles a wedge.

KAR NICOBAR, the northern island of the Nicobar group, is $8\frac{1}{2}$ miles in length, north and south, by 7 miles in width. It is of moderate height, the highest ridge in the south-west part of the island being about 200 feet in altitude, and thickly covered with forest. The north and north-west points of the island should not be approached too close, foul ground extending from them. The south and south-east ends

* Voyage of Austrian I. F. *Novara*, 1858, Vol. 2, p. 40.

† Voyage of Austrian I. F. *Novara*, 1858, Vol. 2, p. 43.

are moderately high, the north end being low, but in no place less than 60 feet above the sea. The island is thickly covered with jungle. Large numbers of cocoa-nuts are exported from this island yearly, chiefly to Burma.

Saoui bay.*—There is anchorage all round Kar Nicobar, but in deep water, except in Saoui bay on the north-west side of the island, where vessels may anchor in from 12 to 14 fathoms, rock and coral, with a light surface of sand. H.M.S. *Arab*, in February 1877, found the best position was in a depth of 7 fathoms, off the observation spot, where there was good landing for boats at low water. The natives of Saoui bay, where the principal village is situated, were found particularly friendly to Europeans, a great number of them talking a certain amount of English. Supplies of pigs, fowls, fruit, and yams were obtainable by barter, old clothes being in great request.†

Fresh water, in case of necessity, may be procured at the Areka rivulet, but not without difficulty.

Tides.—It is high water, full and change, in Saoui bay at 10h., springs rise 5 feet. The flood stream runs to the north-east.

Komios bay on the south side of Kar Nicobar, is where vessels occasionally anchor during the north-east monsoon. H.M.S. *Arab* anchored here in $10\frac{1}{2}$ fathoms, in February 1877, and found good landing at that season. Trading vessels find a berth in from 10 to 12 fathoms, about midway between the two villages, situated on the shore of the bay, which is a convenient position for shipping the cocoanuts.

Tides in Komios bay are regular and strong; the stream of the flood sets to the E.S.E. about 3 knots at springs, the ebb in the contrary direction.

The tides round Kar Nicobar run with great velocity, making tide races, particularly to the northward of the island.‡

TEN DEGREE CHANNEL, about 80 miles in width, separates Kar Nicobar and Little Andaman island. It takes its name from the tenth parallel of north latitude, which may be said to pass through its centre; the Ten Degree channel is free from sunken dangers, or obstructions to navigation.

ANDAMAN ISLANDS.§

The Andaman islands form a considerable portion of the chain of islands extending from cape Negrais in Burma, to Achi head on the north

* See plan of Saoui bay, scale, $m = 1\cdot12$ inches, on Admiralty chart of Nicobar islands, No. 840.

† Remark Book of Commander F. H. D. Broughton, R.N., H.M.S. *Arab*, 1877.

‡ Commander F. H. D. Broughton, H.M.S. *Arab*, 1877.

§ See Admiralty chart of the Andaman islands, No. 825.

coast of Sumatra, stretching from latitude $10^{\circ} 30'$ to $13^{\circ} 45' N.$, and from longitude $92^{\circ} 15'$ to $93^{\circ} 15' E.$. They consist of the Great and Little Andaman groups and numerous smaller islands. Between the Andaman islands and cape Negrais are two small groups, Preparis and the Cocos. The Great Andaman group is separated by narrow unnavigable straits, into three large islands termed North, Middle, and South Andaman, with a fourth of smaller size, Rutland island, to the southward of them. Little Andaman island lies 30 miles southward of the Great Andaman group. The principal harbour, port Blair, is situated on the south-east side of South Andaman island. In 1789, a survey of the Andaman islands was made by Lieutenant Archibald Blair, and in the same year the Bengal government established at port Blair a convict establishment. In 1795 an ill-advised change to port Cornwallis on the east side of the North Andaman island took place, which resulted, owing to sickness, in the abandonment of the colony in 1796. In March 1858, a penal settlement at port Blair was again established by the Indian government, and still continues.

The natives of the Andaman islands are of a low type, apparently oriental negroes, whose origin is involved in obscurity. Few exceed 5 feet in height, their skin is very black, and their limbs slender in proportion to their bodies; few pass the age of 40. They go naked, and live in leaf dwellings hardly deserving the name of huts. Their weapons consist of bows and arrows, and spears. An effort to produce a grammar and dictionary of their language has been made.* The inhabitants of Little Andaman are said not to understand those of South Andaman. As far as is known at present (1885) the chief tribes are nine in number.

THE CLIMATE is very moist, the islands being exposed to the full force of the south-west monsoon, only four months of fair weather, January to May, can be counted on. The rainy season lasts from June to September, and what is called the moderate season from October to January. The average annual rainfall varies from about 100 to 155 inches. The mean temperature is about 81° . The neighbourhood of the Andaman islands is considered the birthplace of the violent cyclones which occasionally visit the bay of Bengal, but authentic information on this head is still wanting.

For account of winds and weather among the Andaman islands *see* pages 10 and 13.

LITTLE ANDAMAN ISLAND, termed Patang by the natives, and inhabited by the Jawara (Da) tribe, is 26 miles in length, north

* See note on two maps of the Andaman islands, to illustrate a grammar and dictionary of the Andamanese languages, in *Journal of R. G. Society* for 1880, Vol. 50, p. 255.

and south, by about 15 miles in width. It is well wooded, and when first seen, which will be at a distance of 20 miles, it has a level appearance, rising gradually towards the south centre. The soundings round the island vary from 10 to 20 fathoms at distances of from one to 3 miles. Shoal water extends for a distance of about 2 miles, north, of the north coast of the island.

A shoal consisting of patches of sand and black rocks is situated 5 miles W.S.W. of Sandy point, the south-west point of Little Andaman island. This shoal covers a space (as charted) 6 miles in length in an east and west direction, by 4 miles in width, but it has not been thoroughly surveyed. Between the shoal and Sandy point, the channel has depths of 12 and 20 fathoms.

South Sentinel is a small island about $1\frac{1}{4}$ miles in length, W.N.W. and E.S.E., and bears W.N.W. from the north-west point of Little Andaman island, distant 15 miles. From its north and south points, reefs extend for about a quarter of a mile seaward. The South Sentinel is well wooded, and can be seen at a distance of 18 miles.*

Brothers are two small islands lying about 3 miles north-east and south-west of each other, and about $4\frac{1}{2}$ and 8 miles north-east of the north coast of Little Andaman island. The trees on the southernmost Brother are ragged in appearance, but on the north Brother they are level, on which account it has been sometimes termed Flat island. Reefs extend from each of the Brothers,† and between them is a detached patch known as Leeboard ledge. The channel between them cannot therefore be recommended. Between the South Brother and the north-east part of Little Andaman island is Ariel passage, so named after H.M. sloop which passed through it, finding depths of 6, 8 and 12 fathoms; but a detached patch, known as Ariel ledge, narrows the channel considerably, and it cannot be recommended.

DUNCAN PASSAGE, 9 miles in width, is the main channel between the Little and South Andaman islands, and named after the captain of the *Ganges*, who in 1760 first successfully navigated it on a voyage to Manila. The depths in this channel are from 12 to 20 fathoms sand, so that a vessel may anchor in case of being overtaken by darkness.

* The position of South Sentinel island needs verification. H.M.S. *Euryalus*, November 1878, after sighting North Sentinel, failed to see South Sentinel, though a direct course was steered for it; the weather was hazy with heavy rain squalls.—(Remark Book of Lieut. H. C. B. Hulbert, R.N.)

† Dangerous rocks, sunken and awash, extend from the southernmost of the Brothers islands in a N.N.W. direction for a distance of from $1\frac{1}{2}$ to 2 miles; and in a S.E. direction for the distance of about $1\frac{1}{4}$ miles. Vessels should consequently be navigated with great care in this vicinity.

Directions.—In light breezes and fine weather the tidal sets through the Duncan passage are fairly regular, but at times currents prevail which are generally governed by the wind. In the north-east monsoon, on both sides of the Andaman islands, the current sets mostly to the south-west or southward. A ship in making the Duncan passage, should therefore endeavour to keep a little to the northward in this season, and to the southward during the south-west monsoon, according to the prevailing wind, so as to preserve a leading wind in passing through the channel.*

The Sisters on the north side of the Duncan passage are two small islands close together on a north-east and south-west bearing, the southern of which is of round shape. The Duncan passage has been said to exist between the round Sister and flat Brother. The round or southern Sister bears N.E. by N. distant 9 miles from the northern or flat Brother, and is approximately in lat. $11^{\circ} 10' 45''$ N., long. $92^{\circ} 44' 50''$ E.

Passage island, about a mile in extent, lies about 4 miles to the north-west of the Sisters, and has, about half a mile N.N.W. of it, a detached rock, small and awash, but easily seen by the breakers.†

Cinque islands extend in a chain in a N. by E. and S. by W. direction, and are moderately high, being visible at a distance of 14 miles; they apparently consist of three islands joined by reef. The south point of the southern Cinque island bears North, distant 3 miles from the north part of Passage island.

The channel between Passage island and Cinque island, discovered in 1760, by Captain Duncan, of the *Ganges*, was successfully navigated and reported safe by H.M.S. *Rifleman* in 1878.

RUTLAND ISLAND, pear-shaped, apex to the north, about 9 miles in length, north and south, by 5 miles in width, is separated from Cinque islands by Manner's strait, about 2 miles in width, and said to be free from danger, and from South Andaman island by Macpherson strait, which at the north point of the island is but 2 cables wide, and affected by strong tides. Rutland island is well-wooded, and has abundance of fresh water, the highest peak, mount Foord, is 1,400 feet high. On its eastern side, a bight runs in for about $1\frac{1}{2}$ miles, known as Portman bay. The trees on its south side show signs of the severity of the south-west monsoon.

MACPHERSON STRAIT is navigable, but the western entrance should not be attempted without a pilot. Several large steam vessels have passed through; but the tides are rapid, and the passage is not recommended.

* Horsburgh, 8th edition, pp. 706, 707.

† Lieut. H. C. B. Hulbert, R.N., H.M.S. *Euryalus*, 1878.

The Twins are small islands, close together, bearing east and west of each other, distant about a mile westward of the west point of Rutland island. A reef extends from the western Twin for about a mile in a W. by S. direction.

LABYRINTH ISLANDS are to the north-west of Rutland island near the western shore of the South Andaman island, and off the western entrance of Macpherson strait. They are but little known, but believed to be numerous, and in some cases connected by reef.

NORTH SENTINEL island is about 14 miles W. by S. of Labyrinth islands, the channel between carrying 40 to 50 fathoms, the bottom generally ooze. North Sentinel is level, covered with trees, and about 150 feet high. Reefs extend around the island for about a mile from the shore, and an islet lies near the north-west point, and two more near the south coast. The reef off the south-east end has been reported to extend farther out than the chart shows. The landing place is said to be on the eastern side of the island. The shape of the North Sentinel is nearly square, and it measures about $4\frac{1}{2}$ miles north and south, by the same distance east and west. The natives here, never visited by Europeans, have the reputation of being savage and treacherous.*

INVISIBLE BANK, about 30 miles in length, north and south, by 13 miles in width, lies about 41 miles due east of Sister islands of the Duncan passage. The soundings on this bank, the water over which does not appear discoloured, vary from 17 or 18 to 40 and 50 fathoms. Its limits have not been satisfactorily determined.

Flat rock awash at high water, of circular form, about 30 yards in diameter, with foul ground extending from it about twice its length to the southward, is situated on Invisible bank, a little south of its centre in about lat. $11^{\circ} 8' N.$ long. $93^{\circ} 31' E.$ At a short distance from Flat rock the soundings are 13 to 20 fathoms, coral and sand, increasing to 30 or 40 fathoms towards the edge of the bank.

Caution.—Vessels in the neighbourhood of Invisible bank and Flat rock should keep the lead going, the position of the latter as given being approximate only.

BARREN ISLAND, in about lat. $12^{\circ} 15' N.$, long. $93^{\circ} 50' E.$, is 1,158 feet in height, and visible at a distance of 35 miles. From the eastern shore of Outram island, one of the islands situated immediately eastward of the Great Andaman group, it is distant 42 miles, on an East bearing. Viewed from the south, Barren island has a bluntly conical aspect, its volcano situated near the centre of the island, and 1,015 feet in height, being generally in an active state. Landing on Barren island

* Nav. Lieutenant J. Tully, H.M.S. *Rifleman*, 1878.

was effected in February, on a small beach on its western side, between the scoria and the hills to the north. "Found very good landing, but no anchorage. There is a good deal of stunted shrub and plenty of coarse grass, but we could discover no water anywhere in the valley, and I much doubt there being any on the island. Several small birds and flying foxes were seen, but no animals. A strong current was running to the southward, along the east side of the island, causing a tide rip to the southward of it."*

NARKONDAM ISLAND, the approximate position of the centre of which is in lat. $13^{\circ} 26'$ N., long. $94^{\circ} 15'$ E., is an extinct volcano, 2,330 feet in height and appears like a truncated cone. In clear weather it may be seen 45 miles distant. Close to its east side is an islet or rock, and off both its north-west and south points are also islets. The natives of the Andaman islands, from the east coast of the north island of which, Narkondam is distant 71 miles in an easterly direction, occasionally visit it to catch fish and snakes, which are said to be abundant. No sunken dangers are known to exist near Narkondam island, and the depth at a distance of 2 miles S.E. of its south-east point, is 450 fathoms, sand.

SOUTH ANDAMAN ISLAND, separated from Middle Andaman by the narrow and intricate Andaman strait, is 44 miles in length, north and south, by from 16 to $2\frac{1}{2}$ miles in width. On its eastern side are situated ports Blair and Meadows, and on its western side, ports Mouat and Campbell. Of the interior but little is known. The native name for this island is Elakabea (Da) and the name of the tribe which inhabit it is Bojigngiji (Da).†

PORT BLAIR‡ at first called port Cornwallis, then port Chatham, and eventually by its present title, after the Lieut. Blair who first surveyed and colonised it in 1789,§ is an excellent harbour and the head-quarters of the representative of the Indian Government amongst the Andaman and Nicobar islands.

It is a narrow inlet running in a west and then a southerly and south-west direction for about 6 miles, with numerous arms branching from it, and towards its head becomes too shallow for vessels of large draught.

* Commander F. H. D. Broughton, R.N., H.M.S. *Arab*, Feb. 1877. For description of Barren and Narkondam islands mapped by Captain Hobday, G.T.S., in 1884, see Part IV. *Memoirs of Geological Survey of India*, pp. 36 (251-286), and R.G.S. *Journal* for November, 1885, p. 776.

† These names are in the Bojigngiji language, the only one with which we are at present familiar.—(Note on map of Andaman islands by E. H. Man, M.R.A.S., p. 254 of R. G. S. *Journal* for 1880.)

‡ See Admiralty plan of port Blair, No. 514, scale, $m = 4 \cdot 15$ inches.

§ See *Memoirs of Hydrography*, 1st Part, page 18.

The north entrance between North point and Ross island is about $1\frac{1}{4}$ miles in width; from this it runs west for $2\frac{1}{2}$ miles to Chatham island, which is the head-quarters of the convict establishment. Here the harbour narrows to a breadth of three-quarters of a mile, and then trends south for 2 miles to Navy bay having a depth of 4 fathoms at low water, and then for about $2\frac{1}{2}$ miles in a south-west direction past Viper island (where the hospital is) to Flat bay, a shallow bight, terminating in extensive mud flats which dry at low water.

The north shore is high, rising abruptly to an elevation of about 300 feet, the western end of the harbour is also high, but the southern shores are lower. Mount Harriet, 1,186 feet in altitude, is situated about $1\frac{1}{2}$ miles inland on the north side of the harbour, and is used as a sanatorium, a road leading to it from Semiramis cove. At its foot is where the late Lord Mayo, the Viceroy of India, was assassinated on the 8th February 1872. No vessel is allowed to visit port Blair for commercial purposes, this being a penal settlement.

Ross Island, on the south side of entrance to port Blair, is about three-quarter of a mile in length north-east and south-west, by 3 cables in width and about 150 feet high. Near the north end of the island is a flag-staff 120 feet in height, and on the highest part is Government house, facing the sea, and approached by a road terminating in a pier on the western side of the island.

Anchorage in from 7 to 8 fathoms, mud, sand, and coral, may be had about 2 cables south-west of the western extremity of Ross island.

BUOYS.—Two red buoys in 6 fathoms of water, mark the western limit of the shoal water extending north-west and westward of Ross island. A red buoy marks the north-east limit of the shoal water, known as Blair reef, extending eastward from Blair point, and bears E.S.E., distant about 6 cables from Chatham island. Higher up the harbour, about 9 cables south-west of Chatham island, a red buoy in 6 fathoms, marks the western limit of a shoal, which extends about a cable westward of Hood point.

In the south entrance to Port Blair, about 9 cables south-east of South point, a red buoy moored in 6 fathoms, marks the eastern edge of two patches of 9 and 12 feet, which are here situated about $1\frac{3}{4}$ cables apart, the outer or 12 feet patch being half a mile from the shore.

A fixed *red* harbour light is shown at the end of the pier or landing place, on the west side of Ross island.

OBSERVATORY.—Chatham island observatory, as deduced from 202 observations of lunar zenith distances, and 29 culminations, by the G. T. Survey of India, was found to be in lat. $11^{\circ} 41' 18''$ N., long. $92^{\circ} 43'$ E.

Tides.—It is high water, full and change, at 9h. 30m. Springs rise about $7\frac{1}{2}$ feet. An automatic tide gauge under the Tidal and Levelling Department of the G. T. Survey of India, is established at port Blair.

Supplies.—There is a moderate supply of coal at port Blair for the government steam vessel; but only small quantities for a vessel of war; it is brought down in lighters from Chatham island.

Excellent water is brought from Hope town, about 2 miles from Ross island; when the settlement lighter can be spared, the water is brought alongside in tanks. At Ross island, water is led down the hill side in pipes to the pier, and can be turned on into a boat alongside, but it is not so good in quality as the Hopetown water. Fresh provisions can be procured from the commissariat. Small repairs might be executed here as there are a number of Chinese carpenters.

There is mail communication monthly with Calcutta and Rangoon and with the Nicobar islands, at which place there is a branch establishment.*

The coast of South Andaman island, from port Blair southward to the entrance of Macpherson strait, at the south end of the island, a distance of about 12 miles, is bold and apparently free from danger. The 100 fathom line, here approaches the coast, to within a distance of $1\frac{1}{2}$ miles.

North of port Blair the coast is also bold and straight, and trends in about a N. by E. direction, for about 14 miles to Shoal bay. The land above this part rises in a broken ridge, highest near port Blair, where it reaches an attitude of 1,067 feet, and as it terminates abruptly, it pointedly indicates the locality of the port.

Shoal bay runs in a W. by S. direction for $2\frac{1}{2}$ miles, and has at its entrance a depth of $4\frac{1}{2}$ fathoms, rapidly shoaling however to depths of from 1 to 3 fathoms. Kyd island separates it from Oyster bay.

Oyster bay, 2 miles north of Shoal bay is narrow, extending in a westerly direction for about 2 miles, the south shore being formed by the north coast of Kyd island. In it are depths of from 5 to 10 fathoms.

PORT MEADOWS† 2 miles northward of Oyster bay, extends in a westerly direction for about 2 miles, and though narrowed in the entrance by Entry island to a width of $1\frac{1}{2}$ cables, opens out inside, into two considerable sheets of water, in the southern of which there is good anchorage in 9 fathoms. On the north side of the passage leading in, are two patches of 4 and $4\frac{1}{2}$ fathoms, for the position of which, as well as for general guidance, the reader is referred to the chart. North of Entry island the passage appears blocked by shoal patches. The shores of port Meadows have coral reefs extending off them, and the surrounding land is generally low, with

* Remarks by Commander F. S. Clayton, H.M.S. *Rifleman*, 1878.

† See Admiralty plan of port Meadows, No. 839, scale, $m = 6.25$ inches.

extensive tracts of mangrove jungle, intersected by creeks and forming several small islands.*

ANDAMAN STRAIT† separating the South and Middle Andaman is narrow and intricate, its eastern end in lat. $12^{\circ} 2' N.$ being blocked by a bar, the depth over which is from 9 to 12 feet. It has been described "as a narrow deep crevice between the mountains, by which it is bounded on both sides, and which are in no part distant from it much more than 300 yards. The channel is narrowed at one or two points to about 80 yards, its general breadth being from 400 to 500 yards. A depth of from 12 to 14 fathoms is generally found throughout the narrow part of the strait. In 1857, the western entrance had a depth of from 4 to 6 fathoms, and the eastern 6 to 10 feet, over a bank of sand and mud."‡

Tides.—It is high water, full and change, near the south part of Andaman strait at 10h. 24m., and near the north part at 9h. 42m. Springs rise 8 feet. The stream of the flood tide sets to the southward through the strait, but is weak, not exceeding $1\frac{1}{2}$ knots.

For description of the western coast of South Andaman island see page 269.

THE ARCHIPELAGO which extends north and south-eastward of Andaman strait for a distance of about 33 miles, consists of numerous islands of various sizes, not sufficiently examined to show what harbours they contain. It was about here that the *Briton* and *Runnymede* troopships were wrecked in 1844. Diligent strait separates the Archipelago from the east coast of the Middle and South Andaman islands. The principal islands are as follows :—Sir Hugh, Neill, Havelock, Henry Lawrence, Outram and Button islands. The majority are high and well wooded, connected by reef, with sunken dangers scattered amongst them. The bank of soundings to the 100 fathom line, apparently extends about 8 miles eastward of their eastern coasts. The southernmost islands of the Archipelago (Sir Hugh, Neill, Havelock) are easily recognised, but may be collectively out of position. The channels and islands, though not to be depended upon, to fix the position by cross bearings, in the main are correct and a good guide.§

Sir Hugh Island, the south island, which is very small, bears from port Blair E. by N. $\frac{3}{4}$ N., distant 21 miles. It is seated upon a coral bank, the least water on which is 7 fathoms. A small reef extending from its south extremity has 3 fathoms water over it, at about half a mile from

* Imray's Bay of Bengal Pilot, p. 250.

† See Admiralty plan of Andaman strait, No. 838, scale, $m = 1\cdot55$ inches.

‡ Lieutenant J. A. Heathcote (late I. N.), 1857.

§ Captain A. Kennedy, H.M.S. *Briton*, 1884. Also, Nav. Lieut. Robert Jackson, H.M.S. *Glasgow*, 1872.

the island.* The passage between this island and Neill, the second island is clear, the ground coral, with depths of 5 fathoms.

Neill Island is moderately high, the greater part rocky, but covered with trees, except some cliffs which rise abruptly from the sea at the north-east end. From the south point a reef extends a short distance, and on this the sea breaks half a mile from the shore. The passage between Neill and Havelock (the second and third islands) is nearly 2 miles broad and clear of danger, with deep water near Havelock island.

Havelock Island is of triangular form, with a considerable projection on the north side. The south point, which is acute, is formed of high white cliffs; one in particular, which is almost insulated, has from some positions the appearance of a sail. On the south-west side are two small bays, where a few natives usually reside, and at this part the water is deep, there being 40 fathoms at a distance of 2 miles from the shore. Between the north-west and north points, the soundings are regular, but from the north point, a reef extends for 3 miles in a N. by W. direction; at either end of this reef is a narrow passage, leading to the small but convenient anchorage, situated on the eastern side of the reef, or between it and the south-west shore of Henry Lawrence island. The north-east part of Havelock island should not be approached from the eastward nearer than 3 miles, to avoid a coral reef, apparently connected with the island. The passage between Henry Lawrence and Havelock islands has been used by a local steam vessel, but the channel is not recommended.†

Henry Lawrence Island has an irregular figure and surface, to which the depths near it correspond. It is probably intersected by narrow channels, otherwise it would be the largest of the Archipelago, measuring 13 miles in length north and south, by about 9 miles in breadth. The east side of the island is deeply indented and probably cut up into islands. Minerva ledge, over which is a depth of 12 feet, is situated about 5 miles eastward of its eastern side; and about 6 miles to the north-east of Minerva ledge, and 5 miles eastward of the coast of East or Inglis island, is Jane patch, the existence of which is doubtful.

Round hill, of regular shape, and the highest land of the Archipelago forms the north-west point of Henry Lawrence island, and can be seen from a distance of 30 miles in clear weather.

The passage between Henry Lawrence and Outram islands has deep water in its western part, but in the middle, a reef extends from Henry

* This reef would appear of doubtful existence, for Captain A. Kennedy, R.N., H.M.S. *Briton* remarks, 1884, "Sir Hugh island, which was passed close to on its south side " appears free from dangers."

† Nav. Lieut. J. Tully, R.N., H.M.S. *Rifleman*, 1878.

Lawrence island, and a bar of sand and coral with 3 fathoms over it, stretches across the eastern entrance.

Outram island is low, and almost divided by bays which run in on its north and south sides; the water near it is deep and the soundings regular.

THE COAST of Middle Andaman island, from the eastern entrance of Andaman or Middle strait, trends in a N.E. by N. direction for about 13 miles, and is deeply indented with bays and inlets. Some parts of the land here are low, and others rise most abruptly. Then commences a chain of islands, reefs, and rocks extending for about 15 miles in a N. by E. direction, and forming the western side of Diligent strait, chief amongst which are Strait,* Colebrooke, Guitar and Long islands. Of these Lieut. Blair remarked: "The bays and inlets formed by the three islands north of Strait island, of which Long island is the northern, are too confined and intricate to be of material use, though they might afford shelter in the event of a vessel being driven in by distress. Abreast the south end, eastward of the middle, and towards the north extremity of Long island, there are three dangerous patches of coral, about 2 miles distant from the island."

The small inlet in lat. $12^{\circ} 29' N.$, is very remarkable, having a bold bluff point on each side. The entrance is narrow, and there is not sufficient depth within for ships. A reef extends eastward from the north point of entrance to the inlet, and there is rocky ground for $1\frac{1}{2}$ miles northward of it. From the small inlet, the coast has a northerly trend, and rises rather abruptly to a considerable height near the entrance of Stewart sound in about lat. $12^{\circ} 52' N.$, which is the northern limit of the island.

BUTTON ISLANDS consisting of the North, Middle, and South Buttons, are three small islands situated N. by W., N.W., and S.W. of the west part of Outram island, distant in each case about $2\frac{1}{2}$ miles. They serve as marks for entering Diligent strait from the northward. North Button is of white sandstone and thickly covered with trees, a sandbank extends for 3 cables off its south-west end.

DILIGENT STRAIT.—The channel between the Archipelago, and the east coast of Middle Andaman island, is termed Diligent strait, and carries depths of from 8 to 30 fathoms, the former being in its narrowest part, or between Strait island and the north-west part of Henry Lawrence island (Round hill), where the distance across is about 9 miles, and the bottom very irregular. It is considered a safe passage, however, during the strength of the monsoons.†

* The principal of the caves resorted to by the swallow, which builds the edible bird's nest, is at the south point of Strait island, which is rocky, and about 40 feet high.

† Nav. Lieut. J. Tully, R.N., H.M.S. *Rifleman*, 1878. This is the passage used by the steamers plying between Rangoon and port Blair.

Directions from the northward.—Having sighted North Button steer to pass in mid-channel between it and Outram island; when the north-west and north-east points of Outram island are in line, steer for South Button, leaving that island on the port hand. After passing South Button, which is steep-to, steer mid-channel between Round hill point and Strait island.

The shoal off Round hill point should be avoided, though there is reported to be not less than 4 fathoms on it. When Round hill point bears East, a course may be steered for port Blair.

From the southward, vessels running through Diligent strait should keep in mid-channel, and make frequent use of the lead, passing midway between Strait island and Round hill, thence pass about a mile westward of South Button, and mid-channel between North Button and Outram island.

ANCHORAGE.—During the north-east monsoon there is anchorage on the south side of North Button islet: also, on the south side of Middle Button, but care should be taken to avoid a patch of coral which has only 12 feet, lying S.S.W. one mile distant from the west end of Middle Button. A reef extends S.S.W. from the same islet.

There is good anchorage south of Strait islet, taking care not to round the south point within half a mile, so as to avoid a patch of 2 fathoms, coral, situated 3 cables south of the south point. There is a depth of 7 fathoms between this patch and Strait island.

The bay between Round hill and Wilson island should be avoided, as the reefs extend much farther out than was formerly supposed.

SOUND ISLAND in lat. $12^{\circ} 55' N.$, near the shore and off the north-east point of Middle Andaman island, is of irregular quadrilateral shape, and about 5 miles in length, north-east and south-west, by $2\frac{1}{2}$ miles in width. It forms the eastern side of a land-locked bay, accessible at all seasons to vessels of every class. The island consists of ridges of high land traversing it in all directions, and prolonged in spurs to the points of the bays indenting its margin. It is fringed with belts of mangrove and surrounded by coral reefs, with occasional sandy beaches near the shore. There is good anchorage between the north side of Sound island and North Andaman, in 10 fathoms, clay.

STEWART SOUND.—Towards the south end of Sound island is a horse-shoe shaped harbour, nearly three-quarters of a mile in depth, and rather more than half a mile in breadth. Its northern and eastern sides are skirted by coral banks, but in the rest of its extent it has good anchorage for large vessels. The ridge of hilly ground surrounding Stewart sound is about 120 feet in height.

The western or upper portion of Stewart sound appears to connect by water with Austin strait, which divides the North from the Middle Andaman island. "The existence of a practicable passage from the east to the west coast of the Great Andaman, debouching at Interview island, had been left undetermined by Lieutenant Blair."*

Tides.—It is high water, full and change, in Stewart sound at 9h. 45m. Springs rise $8\frac{1}{2}$ feet.

The East Coast of North Andaman island, between Sound and Craggy islands, trends about N. by E. for a distance of 16 miles, is hilly to the water's edge, and affords no good landing place. In one or two places a near approach reveals some tolerably deep caves. The soundings off it are said to be regular to the distance of 5 miles, at which distance the depth is 100 fathoms.

Craggy Island, 16 miles northward of Sound island, and 4 miles southward of the entrance to port Cornwallis, is small and connected to the shore by a reef, on the south side of which is anchorage in from 4 to 10 fathoms. The coast near Craggy island is apparently well peopled.

SADDLE HILL, about 2,400 feet high, visible 60 miles, and the most elevated land of the Andaman islands, is situated about 6 miles inland from, and W. by S. of, Craggy island. Saddle hill, which is covered with vegetation, appears as two peaks when viewed from the east or westward, giving the hill the appearance of a saddle, hence its name.

PORT CORNWALLIS.†—The entrance of which is $4\frac{1}{2}$ miles distant from and N. by E. of Craggy island, or in about latitude $13^{\circ} 17' N.$ extends about 6 miles in a north-west direction, and has an average breadth of $2\frac{1}{2}$ miles. The convict settlement which was established here from 1792 to 1796, was situated on Chatham island, which is about $1\frac{1}{2}$ miles in length north and south, and 4 miles from the harbour's entrance. The site on account of its unhealthiness was abandoned. Dense belts of mangrove line the shores, otherwise it is a fine harbour, affords an abundant supply of fresh water, and has more than one bank of palatable oysters. No inhabitants were seen.‡

The entrance to port Cornwallis 2,500 yards in width is easy, and may be recognised as the first opening to the northward of Saddle hill. It is

* Report of Dr. Mouat, who in 1857, conjointly with Lieut. Heathcote (late J. N.), drew up a report on the Andaman islands for the Indian Government.

† See Admiralty plan of port Cornwallis, No. 837, scale, $m = 1.57$ inches.

‡ At about 1,200 yards above Perseverance (or second north) point on the east side of the harbour, is a spring of fresh water, which in February 1793 yielded 150 tuns a day. Nor was there any diminution in the supply up to the latter part of the dry season. Near Hood (or first north point) is another productive spring.

bounded on the north by a reef extending from Ross island, which island is connected with the north point of entrance, and on the south or opposite side by South reef. The spit extending from South reef to the north-east is extremely narrow, and on one spot there is only $3\frac{1}{2}$ fathoms at low water.

Atalanta bay is the first bight westward of South or Dundas point, and is a good situation to anchor in during the south-west monsoon. Brush or St. George islet, is situated nearly mid-channel 2 miles north-west of the entrance to the harbour, which above this, opens out to a sheet of water measuring 2 miles in breadth, and $1\frac{1}{2}$ miles in depth, with excellent anchorage in from 5 to 13 fathoms.

Leading mark for entering the harbour. Lieut. Blair in 1791 gives the north point of Chatham island touching the western extremity of an island situated at the head of the harbour, and marked H on the Admiralty chart.

Approaching the entrance from the southward, no danger need be apprehended, the shore being bold and soundings regular to a distance of $4\frac{1}{2}$ miles off shore.

To the northward of the harbour entrance, dangers extend as far out as a depth of 15 fathoms, particularly a ledge of rocks which uncover at half ebb, one mile south-east of Table islands and 6 miles N. by E. $\frac{1}{2}$ E. from the entrance of the harbour, which should be given a wide berth.

Tides.—It is high water, full and change, at 10 h.; springs rise 8 feet 8 inches.

TABLE ISLANDS are situated about 7 miles northward of the entrance to port Cornwallis, and extend to a distance of nearly 3 miles from the shore, with which they are connected by a reef, the outer edge of which is probably at some distance eastward from the islands, and steep-to. Vessels are recommended to give Table islands a berth of not less than 3 miles and not to stand into less than 25 fathoms, on that part of the coast between cape Price and port Cornwallis.

The Coast from Table islands, takes a westerly direction for about $2\frac{1}{2}$ miles, forming Cadell bay, in which good anchorage has been reported during both monsoons; it then trends north for about 8 miles, terminating at cape Price, which is the northern extremity of North Andaman island.

Union Ledge is the easternmost of the known dangers off the north-east end of North Andaman island. It bears E. by S. $\frac{1}{2}$ S., distant 8 miles from cape Price, and has over it a depth of 6 feet at low water. It is said to be half a mile in length north and south, by 300 yards in breadth, and the soundings outside it, though deep, are irregular.

Jackson Ledge has also a depth of 6 feet at low water, and bears from cape Price N.E. $\frac{1}{2}$ E. distant 6 miles. It extends about half a mile in a north-west and south-east direction, and is about a quarter of a mile

in breadth. East island bears from it W. $\frac{1}{4}$ S. distant 3 miles, and between East island and Jackson ledge is Ranger reef, having over it 4 feet of water. The bottom is uneven, and there are overfalls between Jackson and Union ledges and the north-east coast of North Andaman island.

Pocock Island is small, with rocks extending off it, and bears E.S.E. distant $1\frac{1}{2}$ miles from cape Price.

LANDFALL ISLAND.—Off the north end of North Andaman island are some islands and reefs, the largest of which is Landfall island, which with East island (both about 100 feet high), immediately eastward of it, is situated on a reef, and it is probable that there is no passage between them. Landfall and East island, with their connecting reef, should not be approached nearer than in a depth of 18 or 20 fathoms, particularly in the night, or during thick weather.

Cleugh reef is dangerous, lying midway between Landfall island and the north end of North Andaman. It is just awash, and extends farther to the south than was formerly supposed.

Cleugh passage, between Landfall island and Cleugh reef, off the north end of North Andaman island, was passed through by H.M.S. *Rifleman* in 1878. There is also a passage south of Cleugh reef, but neither should be used if they can be avoided.*

WEST COAST of the Andaman islands has coral reefs more extensive, and forming dangers to a far greater distance from the land, than on the east coast. Dangerous patches are found at a distance of 20 and 25 miles from the land, the probability of which is indicated by the general dip of the stratified rocks of the islands being to the eastward and at a high angle, sometimes as much as 75° . Throughout the extent of the Andamans the highest land is on the eastern, and gradually descends towards the western shore, consequently marshy localities abound on the western side. The hills throughout are covered from summit to base with luxuriant vegetation. The western side is exposed to the full force of the south-west monsoon; the banks and shoals on this side are also said to have less water on them than is shown on the chart. Hence it will be seen, that the west side of the Andaman islands is by no means a desirable locality, and should be carefully avoided, especially during the season of the south-west monsoon.

CORAL BANKS.—There are three great coral reefs on the western side of the group, namely, West Coral bank, 24 miles in length, north and south, lying from 15 to 20 miles westward of the North Andaman; Middle Coral bank, 10 miles in length, about 18 miles westward of

* Nav. Lieut. J. Tully, H.M.S. *Rifleman*, 1878.

the centre of the Middle Andaman; and South Coral bank, about 5 miles S.S.E. of Middle Coral bank. The depths on these banks, so far as has been ascertained, vary from 4 to 10 fathoms, but all must be considered dangerous and almost unsurveyed.

CAPE THORNHILL bears W.S.W. distant 7 miles from cape Price, and West and S.W. of it, distant in each case about a mile, are White cliff and Reef islands.

West island bears N.N.E. of Cape Thornhill, distant $2\frac{1}{2}$ miles, and is surrounded by a reef, with numerous patches between it and the shore.

Paget and Point islands, close together, and surrounded by reef, lie about 3 miles south-west of Reef islands.

The west coast of North Andaman island trends south from abreast Paget and Point island, for about 34 miles, to the western entrance of the narrow strait which separates North and Middle Andamans.

This part of the coast is strewn with islands and reefs, for the position of which the chart is the best guide.

INTERVIEW ISLAND, moderately high, covered with vegetation, and probably well watered, extends from lat. $12^{\circ} 46'$ to lat. 13° N., and is about 15 miles in length by $3\frac{1}{2}$ miles in breadth, and surrounded by mangrove, except near its south end, where the land is higher. Reef extends from its north and south points.* Eastward of it, is the western entrance to Austin strait, separating North from Middle Andaman island.

Port Andaman extending about 4 miles in a northerly direction, is formed between the south-east coast of Interview island and the north-west coast of Middle Andaman island. In it are depths of 7 and 10 fathoms, and at its head, is Bennett island, having on its eastern side a narrow channel, (Interview passage) which connects the port with Austin strait. On the western side of Bennett island, is also a narrow strait, but apparently blocked with sunken rocks. Water can be obtained from Interview island near the narrowest part of the strait.

Tuft island, about 5 miles S.S.E. of the south point of Interview island, is a bank of sand about 10 feet high. The large bay north-eastward of Tuft island was examined by H.M.S. *Riflesman*, and found to be choked by reefs, and useless as an anchorage.

The west coast of Middle Andaman island, trends on the whole about S. by W. from Tuft island, for about 28 miles to the west entrance of Andaman strait, and appears bold and precipitous, with off-lying islands

* At some distance from the south end of Interview island is South reef islet connected to the island by reef. "We steamed round Interview island, and at its southern extremity, near South Reef island, came into violent collision with the natives in an attempt made to enter into amicable intercourse with them."—*Dr. Mouat*, 1857.

termed Hump and Flat, for the position of which the chart is the best guide. Andaman strait dividing the Middle and South Andaman islands, has been referred to at page 261.

Homfray strait would appear to again divide the Middle Andaman island to the northward of Andaman or Middle strait, thus forming a fourth large island. Little appears to be known about it, however, and its direction and limits appear conjectural.

THE WEST COAST of South Andaman island, has a southerly trend from Andaman strait, for about 17 miles to the entrance of port Campbell. Cape Bluff, the north-west point of South Andaman island, has a reef extending about a mile north from it, otherwise no dangers appear on the chart of this part of the coast.

PORT CAMPBELL * the entrance to which is in lat. $11^{\circ} 59' N.$, is a fine harbour, and contains excellent anchorage in depths varying from 6 to 13 fathoms, over a bottom of ooze. At the entrance are two islets, one on each side, of which that off the west point is named Montgomery, and that off the east Petrie. From these islets, banks extend, contracting the entrance channel to a width of about a quarter of a mile.

The channel being so narrow renders the harbour difficult of ingress and egress, but the shelter within is perfect, the harbour being almost land-locked, and extending about 5 miles in a S.S.E. direction.

Near Montgomery islet is a native village. Wood and water are abundant.

Tides.—It is high water, full and change in port Campbell, at 8h. 26m.; springs rise 6 feet.

The west coast of South Andaman island extends in a southerly direction from the entrance of port Campbell, for about 20 miles, to the neighbourhood of Labyrinth islands (*see* page 257) and port Mouat. This part of the coast is very little known, and appears to have several salient points fringed with coral reefs and dangers. Dr. Mouat observes in 1857: "On attempting to run parallel to the coast in steaming northward, the coral reefs which are here very extensive, were found to be far too near the surface to admit of the passage of a vessel, even of so light a draught as the *Pluto*, the water shoaling rapidly from 8 to $1\frac{1}{2}$ fathoms. An attempt to stand to sea in the direction of the North Sentinel, failed from the same cause."

PORT MOUAT† is situated eastward of the Labyrinth islands, and nearly opposite port Blair on the eastern coast, from the head of which it is distant about 2 miles. This port extends in an easterly direction for about

* See Admiralty plan of port Campbell, No. 836, scale, $m = 3.2$ inches.

† See Admiralty plan of port Mouat, No. 898, scale, $m = 3.9$ inches.

2 miles, the entrance, between Perseus and Andromeda points about 9 cables apart, being narrowed by the fringing shore reefs to a breadth of about 3 cables, the depth here being 9 and 10 fathoms. About a mile eastward of the entrance, the harbour contracts to a width of $1\frac{1}{2}$ cables, and the navigable channel to a breadth of little more than half a cable, the depth just here being from 14 to 20 fathoms. Eastward of this, the harbour opens out into a land-locked basin, in which is excellent anchorage of from 4 to $5\frac{1}{2}$ fathoms.

The track recommended in approaching port Mouat from seaward leads about midway between the north point of Turmugli island (Labyrinth islands) and Palmer point of the South Andaman, on about an E.S.E. course.

A few convicts are stationed at port Mouat, and a message can be promptly conveyed to port Blair by the road which runs between them.*

Tides.—It is high water, full and change, at port Mouat at 8h. 40m. springs rise 5 feet.

For description of North Sentinel, Rutland island, and contiguous coast, see pages 256–7.

COCO CHANNEL between Landfall island of North Andaman island and Little Coco island, is 23 miles in width, and 10 to 50 fathoms in depth. The bottom is of coral, with occasional exceptions of sand and mud. During the north-east monsoon the current sets frequently through the Coco channel to the north-west; but in the south-west monsoon it flows mostly to the eastward. In settled weather, the stream of tide sets, flood to N.N.E., ebb to S.S.W.†

In passing through the Coco channel, a good look out should be kept, it being probable that more reefs exist than the chart shows.

DAPHNE ROCK,‡ situated on the north side of Coco channel, and on which *H.M.S. Diamond* (drawing 18 feet), touched in 1876, lies with the following bearings and distances:—

South-west extreme of Little Coco island	N. $\frac{1}{4}$ W. about $3\frac{1}{2}$ miles.
Table island lighthouse	- - - N.N.E. $\frac{1}{3}$ E. about 20 miles.
South point of Great Coco island	- - - N.E. $\frac{1}{4}$ N. about 13 miles.

* Nav. Lieut. J. Tully, R.N., *H.M.S. Rifleman*, 1878.

† Horsburgh, eighth edition, vol. 2, page 701.

‡ This is considered to be the rock on which the brig *Daphne* struck in the year 1809, and for which the two following positions were assigned; namely, Little Coco island bearing North, distant 6 miles; and S.E. end of Little Coco island bearing N. by E. about 5 miles. This rock had been expunged from the Admiralty charts on the authority of a document received from the Indian Government, one of whose vessels (*Alexandra*) had, about the year 1866, sounded extensively in the neighbourhood of the danger as above reported, but without finding shoaler ground than 40 fathoms, and near the position now assigned to it, not less than 8 fathoms.

There is probably less water than 18 feet on this shoal, and there are depths of 10 and 24 fathoms near, and $5\frac{1}{2}$ to 10 fathoms for a distance of 3 miles in a north-easterly direction from it.

LITTLE COCO ISLAND, in lat. 14° N. and 23 miles N.E. by N. of Landfall island of the Andaman group, is about $2\frac{1}{2}$ miles long, north and south, by half a mile in width. It is of moderate elevation, the highest part near the south end, covered with trees, and can be seen from a distance of 18 miles. Coral reefs surround the island, extending from its south point about half a mile, and from the north, one mile, with two detached patches distant 2 miles N. by E., and one mile N.W. from the north point of the island. The patch on the N.W. bearing, has over it a depth of $2\frac{1}{2}$ fathoms; that on the N. by E. bearing is awash.

Anchorage.—There is said to be fresh water on the east side of Little Coco island, where a ship might anchor in about 12 fathoms; there is also anchorage near the north-west end of the island, with regular soundings towards the shore, and a sandy bay on the west side where boats may land, but no fresh water is procurable.

Little Coco island has the reputation of being swampy, fertile, but very unhealthy. It is occasionally visited by the Burmese who occupy Great Coco island during the north-east monsoon, but they only make short trips to Little Coco, for the purpose of gathering cocoanuts, which are abundant; whatever sickness prevails amongst them, is considered to originate at Little Coco.

GREAT COCO bears N.E. from Little Coco, distant about 10 miles. It is $5\frac{1}{2}$ miles long, north and south, by about 2 miles in width, covered with trees, of uneven appearance, and sufficiently elevated to be visible at a distance of 18 miles. The reef upon which it stands extends about half a mile N.W. of its rocky north-west point, and for about $2\frac{1}{2}$ miles from the south end of the island, having upon it an islet named Jerry. Great Coco island has timber, of large size growing upon it, from which, in emergency, spars might be procured in the case of a vessel becoming disabled in working down the bay of Bengal in the south-west monsoon. It is to a certain extent sheltered from the south-west swell, in common with Little Coco, by the Andaman islands.

Great Coco is occupied by the Burmese during the north-east monsoon, who leave it at the commencement of that from the south-west. Otherwise it is seldom visited, firewood only being procurable, and probably a little water by digging pits.*

Anchorage.—In westerly winds, at the north-east end of Great Coco, in Ford bay, nearly a mile from the shore, vessels may anchor in 9 to

* Horsburgh, eighth edition, Vol. 2, page 701.

12 fathoms, with Pechi head bearing N.N.W. $\frac{1}{2}$ W., distant half a mile, and Lascelles or Rat islet S. $\frac{1}{2}$ W., one mile.*

ALEXANDRA CHANNEL, separating Great and Little Coco islands, about 10 miles in width, has not been surveyed, the only danger so far known, being the detached coral patch on its western side, situated 2 miles N. by E. of the north end of Little Coco island already described. It should be used with caution.

Marshall Channel, separating Great Coco from Table island, is 2 miles across, but only $1\frac{1}{4}$ miles in navigable width. Strong tides and a heavy sea prevail here at the commencement of spring tides, and as the soundings, which show depths of 6 to 12 fathoms, are only approximately correct, its navigation cannot be considered safe without local knowledge

TABLE ISLAND, with its companion Slipper island,† off its north-west point, connected at low water, are together seated on a reef about 2 miles north of Great Coco island, occupying a space about $1\frac{1}{4}$ miles east and west, by $1\frac{1}{2}$ miles north and south. Table island is about 9 cables in extent, about 100 feet high and wooded.

The reef surrounding Table and Slipper islands, extends from the north side of Table island, about $1\frac{1}{2}$ cables, and from its south point about half a mile. At about half a mile from the east side of Table island, is a patch of rock having over it 9 feet of water, on which the sea breaks during the south-west monsoon.

LIGHT.—On the highest or south-west part of Table island is a circular iron lighthouse, 91 feet in height, painted in alternate red and white horizontal bands, from which is exhibited, at an elevation of 195 feet above high water, a *fixed white* dioptric light of the first order, visible in clear weather from a distance of 22 miles. From the Coco channel the light is obscured between the bearings of N.N.E. $\frac{3}{4}$ E. and N.E. $\frac{1}{2}$ N. by Little Coco island, and between the bearings of N. by E. and N. by W. $\frac{1}{4}$ W. by Great Coco island.

Table island light forms for vessels, a good point of fresh departure during the south-west monsoon, while the Alguada revolving light at the northern limit of Preparis north channel, is a good point of fresh departure in the north-east monsoon. By shaping course to sight either of these lights the dangers about Preparis island are avoided. Powerful steam vessels can use the Alguada light as a mark in both monsoons.

Anchorage may be had during the north-east monsoon, on the south side of Table island, in from 7 to 9 fathoms, with the lighthouse bearing

* See plan of Table bay or Marshall channel, scale, $m = 1.2$ inches, on Admiralty chart No. 825.

† Slipper island lies further to the northward than the chart shows. The chart should be used with caution.

N. $\frac{1}{2}$ E., distant about half a mile; also, in a similar depth on the north-west side of the island during the south-west monsoon, with the north end of Slipper island bearing S.W., and north end of Table island about E.S.E., or the lighthouse bearing S. $\frac{1}{2}$ E. distant about 9 cables.* Landing can be effected in the north-east monsoon under the lighthouse by a ledge of rock which extends off the south-west point in a south-east direction, and in the south-west monsoon in the small sandy bay northward of the lighthouse.†

H.M.S. *Diamond*, in 1876, anchored in 10 fathoms about half a mile northward of Table island, with the east extreme of the island bearing S. by W., and the west end of Slipper island W.S.W. At the distance of one mile east, and half a mile north-east from this anchorage, there are depths of 15 fathoms, with apparently deep water up to the rocks which extend about $1\frac{1}{2}$ cables in a northerly direction, from the north-east point of Table island.

Tides.—During spring tides the ebb was observed by the *Diamond* to set N. by W. at the rate of 4 to 5 knots an hour, and the flood S. by E., but with less velocity.

Off the south part of Table island, the ebb sets W. by N., and flood E. by S. The ebb causes heavy tide races off the north-east and south points of the island.

Supplies.—A considerable garden is cultivated on Table island by the lighthouse keepers, from whom vegetables may be procured. Cattle, the property of the Indian Government, are bred upon the island, and thrive in a remarkable manner. The place is considered very healthy.‡

Winds.—Late in February and in March, fresh northerly breezes prevail for 4 or 5 days at a time in the vicinity of the Cocos, and a heavy cross sea gets up in the Marshall channel and northward of Table island when the tide is running against the wind. These northerly breezes are a continuation of the north-westerly sea breezes which blow down the coast north of cape Negrais at that season.

(For further remarks on Winds and Weather of the Andaman islands see pages 10 and 13, and as to Currents, see p. 20.)

* In the north-east monsoon, the water in 7 fathoms is so clear, that the anchor may be seen lying on the sandy bottom.

† During bad weather in the south-west monsoon, when the landing at Table island is dangerous, a vessel may conveniently wait for a break in the weather in Ford bay, on the east side of Great Coco island.

‡ In 1884 the number having become too great for food supply, 41 head of cattle were brought to Rangoon in the I.G.S. *Enterprise*.—(Report on Lighthouses of British Burmah, 1883–84.)

CHAPTER VIII.

PREPARIS CHANNELS AND GULF OF MARTABAN TO TAVOY RIVER.

Variation 2° 30' E. to 3° 5' E. in 1887.

PREPARIS SOUTH CHANNEL, separating Table island of the Coco group, from Preparis island, is about 35 miles in width and has near its central part depths of 109 and 150 fathoms, over a bottom of coarse sand. This channel is often made use of by vessels working down the bay of Bengal against the south-west monsoon from Calcutta and intending to pass eastward or to leeward of the Andaman islands, Table island with its light, affording a good mark for verifying the reckoning and taking a fresh departure from.

Preparis Island, the north point of which is in lat. $14^{\circ} 54\frac{1}{2}'$ N., long. $93^{\circ} 41'$ E., is situated nearly midway between the Great Andaman island and the coast of Pegu. Its north point is distant 55 miles S.S.W. $\frac{1}{2}$ W., from Alguada lighthouse, and 46 miles N. by E. $\frac{3}{4}$ E. from the lighthouse on Table island.*

Preparis island is $4\frac{1}{2}$ miles long N.N.E. and S.S.W. by about three-quarters of a mile in breadth. It is 265 feet in height, covered with wood and slopes gradually to the sea. The east side of the island is steep, there being a depth of 10 fathoms about half a mile from the shore, rapidly deepening to 17 and 22 fathoms. A reef fringes the island and extends from the south point for $3\frac{1}{2}$ miles in a southerly direction.

A rock awash at low water, bears about S.E. by S. from the north-east point of Preparis island, distant about a quarter of a mile from the shore.

Detached reefs.—On the west side of Preparis island, a reef with some islets, about 90 feet high, upon it, has its outer edge $2\frac{3}{4}$ miles distant from the island; in the narrow channel between this reef and the island, the depth is 9 to 15 fathoms. There is also a reef on the south-west side of Preparis island, having at its north end a pinnacle rock, 40 feet high,

* See Admiralty chart of Preparis North Channel No. 152, scale, $m = 0\cdot25$ inches.

and at its south end a small dangerous rock only 6 feet high; it is seated upon a bank of from 6 to 10 fathoms, and its south end is distant from the south point of Preparis about $6\frac{3}{4}$ miles in a S.W. by S. $\frac{1}{4}$ S. direction.

Cow and Calf islets, two clifty, flat-topped islets, close together, and 77 feet high, bear from the north point of Preparis island N.N.E. distant about $1\frac{1}{2}$ miles, and are seated on a bank of 6 to 8 fathoms, which extends from them nearly 2 miles in a south-east direction. A narrow channel, in which are depths of from 11 to 24 fathoms, separates these islets from Preparis island.

Anchorage at Preparis island, during the south-west monsoon, is on the eastern side, in 12 to 14 fathoms, or nearer the island at half a mile from the shore in 8 or 9 fathoms, sand, coral, and shells. Anchorage may also be found on the western side during the north-east monsoon.

Water.—On the east side of Preparis, at a few paces from a sandy beach, formed between two ledges of rock, where boats can land with safety there is a pond of fresh water, convenient for watering; from it the highest part of the island bears N.W. The sands at the north-east corner of the island abound with turtle.

PREPARIS NORTH CHANNEL separating Preparis island from Alguada reef of the Pegu coast at the entrance of the gulf of Martaban, is about 53 miles in width and has depths of from 15 to 20 fathoms 20 miles S.S.W. of Alguada reef, to 30, 40, and 45 fathoms as Preparis island is approached.

Thalia shoal the least water found on which has been 10 fathoms, coral bottom, is about $1\frac{1}{2}$ miles in extent N. by W. and S. by E., and bears N. by E. distant $21\frac{1}{2}$ miles from the north point of Preparis island, in about lat. $15^{\circ} 16' N.$, long. $93^{\circ} 46' E.$ The depths around Thalia shoal vary from 30 to 46 fathoms, the bottom generally consisting of gray sand and coral.

The 100 fathoms line, so far as has been ascertained, appears to run almost due north from Preparis island, to a position about 25 miles westward of cape Negrais of the Pegu coast, and to be subject to but slight indentations.

Tides—It is high water, full and change, in the North Preparis channel at about 9h. 30m.

On the northern side of Preparis north channel, during the north-east monsoon, at Alguada reef, the tides are regular, the rise and fall at springs being 9 feet, and at neaps 6 feet. Here the flood stream sets E. by S., ebbs W. by N., at springs about 2 miles an hour. But in the Preparis north channel itself the tides are very irregular. Here, at springs, the flood stream sets S.S.E. and S.E., and the ebb S.W., with a velocity of about 2 knots.

During the neaps there is a constant set to the south, of from 1 to $1\frac{1}{2}$ knots an hour.*

IRRAWADDY RIVER, the total length of which is about 900 miles, rises in the southern slopes of the Patkoi mountains, one branch, in lat. $27^{\circ} 43'$ N. long $97^{\circ} 35'$ E., and another farther to the eastward. These two, known as the Large and the Small river respectively unite in about lat. 26° N. Its general course which is tortuous as far south as lat. 17° N., is from north to south. At Akauktaung the river enters the delta, hills giving place to alluvial plain, protected on the west by extensive embankments. It reaches the sea by nine principal mouths, viz., the Bassein, (and its eastern entrance the Thek-nge-thaung), Ywe, Pyamalaw, Irrawaddy, Kyondon, Pyapon, To or China Bakir and the Rangoon. Some of these are of considerable breadth, but the Bassein and Rangoon mouths are the only ones at present used by seagoing ships. The Irrawaddy mouth in long. $95^{\circ} 3'$ E. is said to be the straightest and best channel to the sea; it has a depth on the bar of 12 feet at low water springs; but is, however, seldom used as there is no town at the entrance.†

The Irrawaddy delta is constantly encroaching on the sea, owing to the immense quantity of silt brought down by the river, and is cut up into numerous low islands by numerous tidal creeks and channels. Scattered along the south parts of these are temporary villages, occupied during the dry season by salt boilers and makers of *nga-pi* or fish paste.

(For inner navigation of the Irrawaddy river, see page 294, and Appendix, p. 360.)

BASSEIN RIVER‡ is the most westerly of the channels by which the Irrawaddy reaches the sea, with other mouths of which river, it is connected by numerous large tidal creeks. It is navigable for a considerable distance inland. There are two entrances, one on each side of Negrais or Haingyi island; of these the eastern is the navigable channel the western, of late years, having silted up, and become only available for boats. The banks of the river are for the most part low, muddy, and

* We found the ebb set for six hours to N. by E. at half to three quarters of a knot, at neaps. (Commander A. Carpenter, R.N., in charge of India Marine Survey. April 1886.) In December 1885, H.M.S. *Ranger*, when within 60 miles westward of Diamond island, up to her anchorage at that place, experienced a current running at the rate of 2 knots to the west-north-west. The effect of the easterly flood stream was not felt. It is reported that, after easterly winds, the current sets to the westward continuously, along the north coast of the gulf of Martaban.

† Commander H. H. Edwards, R.N., H.M.S. *Ready*, 1881.

‡ See Admiralty chart, Koronge island to White point, No. 823; and Bassein river, No 834; scale, $m = 0.7$ inches.

covered with jungle; in some portions of its course the banks are hilly. Bassein river is about 12 miles wide at the entrance between Pagoda and Porian points, but its breadth soon decreases to $2\frac{1}{2}$ miles opposite the site of the former port, Dalhousie, 9 miles from the sea, now shoaled up and abandoned, and said to be an unsafe place during the south-west monsoon.* The depth within the island of Haingyi is from 5 to 7 fathoms for a considerable distance, but higher up rocks and islands, render navigation difficult. The river is difficult for a stranger, and should not be entered without a pilot.

Diamond island bears S.S.E. from Pagoda point, distant $5\frac{1}{4}$ miles, and fronts the entrance to Bassein river; it is about 50 feet high, covered with trees, has a flagstaff near its north-east side, and may be seen about 15 miles. The landing place is on the eastern side of the island.

Porian point on the east side of entrance to Bassein river bears E. by S., distant about $6\frac{1}{2}$ miles from Diamond island, and is of moderate height with white cliffs, visible 10 to 15 miles. Rocks extend for about $1\frac{1}{2}$ miles S.S.W. of it, and 2 miles W. by N. of it are Martin rocks, above water. The eastern shore of the river within the point is low, and from it Porian shoal extends, the western edge of which, marked by a black buoy in 3 fathoms, forms the eastern side of entrance to the river.

Haingyi (Hengie), or Negrals island, is of triangular shape, about 3 miles in extent N.E. and S.W., and has a conspicuous hill near its north-east end, which is the easternmost high land visible on this part of the coast. The east side of the island is faced by a bank, upon which, at about 4 cables from the shore, is Wolf rock, above water, and easily distinguished when passing up or down the river. The bank had extended about a quarter of a mile eastward of Wolf rock in the year 1878.

Orestes shoal extends south-west of the western side of Haingyi island, or towards Diamond island for about 5 miles. The bottom is rocky and uneven, and has breakers over it at low water, the general depth averaging from $1\frac{1}{4}$ to $2\frac{3}{4}$ fathoms. The eastern edge of Orestes shoal marked by a buoy, in about 4 fathoms, bounds the main channel into the river on its western side.

Buoys.—The Fairway buoy (black and white chequered) is moored in about $5\frac{1}{4}$ fathoms at low water, one mile N.E. of the north-east point of Diamond island.

A red buoy in about 4 fathoms at low water, $3\frac{1}{4}$ miles N. by E. $\frac{1}{4}$ E. of the north point of Diamond island, marks the eastern side of Orestes shoal.

* The ruins of the town, which was laid out with great care, were covered with jungle in 1884.

A black buoy, in 3 fathoms at low water, about 4 miles N.E. of the north point of Diamond island, marks the western edge of Porian shoal. The channel into the river lies between the red and black buoys.

Eastward of Haingyi island, a buoy painted black and white in vertical stripes, is placed about 10 yards N.N.E. of Burgess rock, situated nearly mid-channel, and over which rock is a depth of 17 feet at low water. From the buoy, Ward point on the south side of the river bears E. by N. $\frac{3}{4}$ N., distant $2\frac{1}{2}$ miles.

DIRECTIONS.—The only deep channel into Bassein river is between Orestes shoal and the western side of Diamond island. The fairway buoy (chequered) may be steered for when it bears east, and when the low south-east extreme of Haingyi island bears N.E. by N., the course may be altered to pass between the red buoy on the port hand and the black buoy on the starboard hand. In 1878, the north-east and south-east points of Haingyi island, in line, led over the bar in about 4 fathoms at low water.* Approaching from the southward, vessels should, after passing westward of Alguada reef, bring Diamond island to bear N.E., then steer for it until the Fairway buoy is visible, then as before directed.

Vessels unable to distinguish the different marks from stress of weather or other cause, should anchor near Diamond island, but clear of the prohibited limits hereafter described.

Pilots may generally be obtained at or near Diamond island, and considering the changes reported in the river's entrance since the last survey (1855) it will be advisable if strange to the river to take one. There are fixed rules and a tariff for pilotage, under the port officer at Bassein.

ANCHORAGE, may be had on the east side of Diamond island in about 5 fathoms, mud, about a mile from the shore, in smooth water, care being needed to guard against the reef extending southward from the island, or, if approaching from the northward, at about $1\frac{1}{2}$ miles N.N.W. from the island. The best berth for small vessels is with Pagoda point touching the north-east sandy cape of Diamond island, whilst the south end of the island bushes, bears West.

Prohibited anchorage.—In order to afford protection to the Telegraph cable laid between Diamond island and the north point of Bassein river entrance, two beacons (posts surmounted by boards and painted white) have been placed to mark its position; one where the cable is landed, the other inland on the line of direction of the cable.

* Navigating Lieutenant F. W. Jarrad, R.N., 1878. The Bassein river entrance had much altered since 1855, the date of the last survey. The chart must therefore be used with caution.

Mariners are cautioned not to anchor in this vicinity except with the beacons well open of each other. If the beacons are not visible they should avoid anchoring between the following bearings of the centre of Diamond island, namely, S. by E. and S. by W.

In Gnaputau reach, about 15 miles below Bassein, they should not anchor between the telegraph cable houses (one on each bank of the river, painted white).

Tides.—It is high water, full and change, at Diamond island at 10 h. ; springs rise 9, and neaps 6 feet. The tides are subject to a large diurnal inequality, which may accelerate or retard the times of high and low water, and increase or diminish the rise by more than a foot. It is high water at Bassein about 6 hours after high water at Diamond island.

BASSEIN TOWN, about 55 miles from the mouth of the Bassein river, is resorted to principally for rice, which is shipped in large quantities between the months of January and May. The Shwe Mú-hlaw pagoda on the left bank, now forms the centre of the English fort, which also contains the court-houses, treasury, and police office. The Theng-bhaw-gyeng suburb containing the rice mills and store yards of the principal merchants, is on the opposite, or right bank. The town has a charitable dispensary and a European as well as a native hospital. Population in 1876 amounted to 17,697, and the gross revenue was 5,879*l*. There is a port officer and staff of pilots.

Climate, of Bassein is relaxing, owing to the situation of the town in the *delta* of the Irrawaddy, and to the muddy banks of the river which are exposed during the greater part of the day. In 1877, the total rainfall was 102 inches. Strangers should be on their guard against cholera and fever reported to be endemic; small-pox is much spread by inoculation.

Trade.—The exports were valued in 1877 at 503,468*l*., and consisted chiefly of rice, small quantities of timber, cotton, tobacco and oil-seeds. The imports, valued for the same year at 44,764*l*., consisted of coal, salt, piece goods, cotton stuffs and crockery.

Coal.—Coal can be obtained at Bassein at about Rs. 23 per ton.

Communication; by telegraph exists between Rangoon and Bassein, and to Diamond island at the mouth of the river, where ships call for orders. The Irrawaddy Flotilla Company's steam vessels specially constructed for service through the narrow tidal creeks, ply twice a week between Bassein and Rangoon.

ALGUADA REEF, so-called by the Portuguese, but known to the Burmese as Nagarit Kyauk, is about $1\frac{1}{4}$ miles in length north-east and south-west, and almost awash at high water. The lighthouse on it bears S. $\frac{5}{8}$ W., distant $15\frac{1}{2}$ miles from the Hmaw-dau pagoda, on Pagoda point of

the chart, or in about lat. $15^{\circ} 41' 40''$ N., long. $94^{\circ} 10' 35''$ E. There are detached sunken rocks at a considerable distance from Alguada reef, one with $3\frac{1}{2}$ fathoms, about one mile S. by W. of the lighthouse.

Five separate ridges, extending in a north-east and south-west direction, about half a mile in width, and on which are dangerous rocky patches with from 4 to 13 feet water on them, completely obstruct the channel between Alguada reef and Diamond island. The shoalest patch found, now named Hugh Rose rock, on which the ship *Inchmarnock* struck in April 1877, has 3 to 4 feet over it at low water, and lies N.N.E. $\frac{1}{4}$ E. from Alguada reef lighthouse, distance $2\frac{1}{2}$ miles. Phaeton shoal of 2 feet lies nearly midway between Alguada reef and Diamond island.

Caution.—The channel between Alguada reef and Diamond island is dangerous, and should not be attempted under any circumstances.*

LIGHT.—From a granite tower situated near the centre of the Alguada reef and 160 feet in height, coloured in black and white horizontal bands, is exhibited at an elevation of 144 feet above high water, a catadioptric revolving *white* light of the first order, attaining its greatest brilliancy every minute, visible in clear weather at a distance of 20 miles.

Anchorage.—Between the months of December and April there is good anchorage to the eastward of Alguada reef lighthouse, in 7 fathoms, sandy bottom, with the lighthouse bearing between West and W. by N. distant $1\frac{1}{2}$ miles.

During the south-west monsoon there is anchorage in 6 fathoms, under the lee of the reef, with the lighthouse bearing S.W., and the small basket beacon on the lighthouse ridge bearing S. by W., distant 2 cables.

Tides.—It is high water, full and change, at Alguada reef at 10h. 40m.; springs rise about 12 feet. The tide when uninfluenced by the wind sets across the reef with considerable strength, and also between it and Phaeton shoal; for which reason the north-west side should not be approached nearer than in 20 fathoms, as it shoals suddenly, especially towards the south-west part of the rocks.

Directions.—In the immediate vicinity of Alguada reef is a depth of 5 to 8 fathoms, thence rapidly increasing to 20 fathoms within 3 miles of its western and southern sides; at 3 miles distance to the eastward of the reef is 11 fathoms. Although the lighthouse is an excellent mark for the reef, vessels should not approach it from the westward and southward under

* From the heavy confused swell that generally prevails between the Alguada reef and Diamond island, even during calm weather, it is often called the race of Negrais, and certainly should be avoided by ships; for by rounding the south end of Alguada reef they are but a few miles farther out, and in a safe and spacious channel about 50 miles wide between the Alguada reef and Preparis island.—Horsburgh, 8th edition, Vol. 2, page 668.

20 to 15 fathoms, or at a distance of about 3 miles.* On the eastern side of the reef vessels may know they are clear of danger by keeping the high land of Haingyi (Hengie or Negrais) island well open eastward of Diamond island.

COAST OF PEGU.—The north shore of the gulf of Martaban extends eastward from the mouth of the Bassein river in an easterly direction for about 70 miles, or to the vicinity of the Krishna shoal, and then trends to the north-east for about 120 miles to the head of the gulf into which flows the dangerous bell-mouthed Sittang river. The coast of Pegu, in which is comprised the delta of the Irrawaddy, is low and wooded, and without marked feature discernible outside the extensive shallow bank known as the Baragua flats, which fronts it.

Baragua Flats.—From the entrance to Bassein river the 5-fathoms edge of the coast bank trends E.S.E. for 43 miles, then E. $\frac{1}{2}$ N. 27 miles, and then in a curve to the north-east, to the head of the gulf of Martaban. Inside the 5-fathoms line vessels should not venture, until they reach the vicinity of Rangoon river; but while westward of Krishna shoal, should keep in at least 10 fathoms. Baragua flats extend many miles from the land, which is not visible from their southernmost part. Opposite the main entrance to the Irrawaddy, the 5-fathoms line extends farthest seaward, or to lat. $15^{\circ} 30' N.$ No part of the bank is marked by buoys between Bassein river and Krishna shoal.†

KRISHNA SHOAL is a narrow ridge 13 miles in length N.E. and S.W., and its widest part about 3 miles across, having depths of 8 to 15 feet, hard sand, and is separated from the east side of Baragua flats by a channel $3\frac{1}{2}$ miles broad, and from 3 to 4 fathoms deep. It is a formidable danger to vessels bound to Rangoon from the westward, should they venture too far to the northward.

LIGHT VESSEL.—In August 1877, the iron lighthouse which marked the Krishna shoal was swept away in a storm. A light vessel is now stationed at about $2\frac{1}{2}$ miles east from the south side of the shoal, or 4 miles east of the former position of the lighthouse, in about lat. $15^{\circ} 36' 15'' N.$, long. $95^{\circ} 34' 30'' E.$, which shows at an elevation of 50 feet above the sea

* The height of Alguada reef lighthouse, base to vane, is 160 feet. The angle of elevation of $0^{\circ} 30'$, nothing over, subtended by the lighthouse on a sextant, when rounding to the south or westward, will insure a vessel passing at a distance of at least 3 miles. Cross bearings just here cannot well be obtained.

† It is stated that the soundings in the Martaban gulf have altered considerably since the surveys of the year 1826. Caution is therefore necessary when sounding for the purpose of verifying the ship's position. Allowance should be made for the rise and fall of tide.

a fixed *white* catadioptric light, visible in clear weather 10 miles.* A blue light, the glare visible in clear weather for 20 miles, is burnt every half hour, between 7 p.m. and 5 a.m. The light vessel is painted red, and on the middle or lantern mast, which has a red ball, hoists a red flag by day. During thick or foggy weather, a signal gun is fired every half hour.

CHINA BAKÍR LIGHT, on iron piles, stands on the edge of China Bakír flats, and exhibits at an elevation of 78 feet above high water, a *fixed* and *flashing white* light of the 1st order, interval of flash one minute, visible in clear weather from seaward between the bearings of N.E. by E. $\frac{1}{2}$ E. through North and West to S.W. by W. $\frac{1}{2}$ W., for a distance of 15 miles. The lighthouse is painted red, with white top or lantern. Position lat. $16^{\circ} 16' 33''$ N., long. $96^{\circ} 11' 40''$ E.

China Bakír Flats, which dry at low-water springs, extend along the shore from the mouth of China Bakír river to Elephant point. Their outer or eastern edge is marked by three red buoys (see page 289).

DIRECTIONS FOR APPROACHING RANGOON RIVER.—Vessels bound to Rangoon from the westward should pass south of Alguada reef at a distance from it of about 3 miles, or in about 15 fathoms, then steer about E. by S. for a distance of 55 miles, which should bring the ship into about 10 fathoms, at low water, at about 5 miles south of the 5 fathoms edge of Baragua flats. Then steer from East to E. by N. for about 25 miles, in not less than 9 fathoms, until Krishna light is sighted. After sighting the Krishna light, do not shoal less than 10 fathoms, until China Bakír light is visible.† (See also page 283.)

With Krishna light bearing North, distant 5 miles, a N.E. course for 45 miles, will lead up to within the limit of visibility of China Bakír light. Should a vessel working up the gulf make China Bakír light bearing eastward of N.E., she should at once haul to the south-eastward; and, until the light bears westward of north, it should not be approached nearer than 4 miles. After making China-Bakír light, steer to the north-eastward until the light bears W.S.W., distant about 7 miles, then anchor in about $3\frac{1}{2}$ fathoms at low water until daylight.‡ A depth of 27 feet at low water, will be found with China Bakír light bearing N.W. distant 5 miles.

* The position of the Krishna light vessel, which is maintained by means of marks on shore may be relied on, a red buoy with staff is moored near to and westward of the light vessel.

† In December 1878 H.M.S. *Euryalus*, in proceeding to Rangoon, found the depth between the Krishna bank and entrance to the Rangoon river differ from the chart, but not to any serious extent. The water in parts was found to be about one fathom shoaler than the chart No. 823 showed.

‡ See Admiralty chart:—Rangoon river and approaches, No. 833, scale, $m = 1 \cdot 35$ inches.

Caution.—In rounding Baragua flats, especially at night and during spring tides, sound frequently, do not shoal less than 10 fathoms at low water, and in shaping course, study the time of high or low water, making allowance for an indraught on the flood tide into the mouths of the Irrawaddy. The ground log should be used.

TIDES.—Between Alguada reef and the entrance to Rangoon river, the general set of the flood tide is to the eastward, following the trend of the edge of Baragua flat. At springs, during the north-east monsoon, it sets at the rate of 2 to 4 knots, increasing in strength as a vessel goes farther east. The stream of the ebb is stronger than that of the flood. During the months of November, December, and January there is little or no flood tide felt south of Alguada reef except at spring tides.

During the months of February and March, when thick fogs prevail, great caution is necessary in approaching the entrance of Rangoon river, as there is not a sufficiently marked change in the soundings in the channel to enable the navigator to form an opinion of his position by the lead. By day a vessel should not attempt to enter the river without first sighting China Bakír lighthouse. During the rice season, January to May, the vessels at anchor outside the river will be a guide.

Vessels from the eastward should keep in $5\frac{1}{2}$ or 6 fathoms (low water) until within the limits of visibility of the China Bakír light, and should on no account, in thick weather, attempt to proceed, after running their distance, until China Bakír light is seen.*

Anchorage.—The best anchorage outside for vessels waiting to enter the river is eastward of the Fairway buoy in 21 feet low water (good holding ground), with China Bakír lighthouse bearing W.S.W. distant about 7 miles. This position is out of the full strength of the tide. North of Elephant point there is good anchorage off the white wooden beacon near Motjua village, in from 3 to 5 fathoms, mud, on the north-west tail of the Middle bank. Vessels of deep draught awaiting the tide will find anchorage in 27 feet at low water, 5 miles S.E. of China Bakír lighthouse.

Directions for entering the river, *see* page 290.

Winds.—At the entrance of Rangoon river in the month of December the wind is north-easterly, veering to the eastward and blowing fresh during the day; the weather is generally fine. In January the wind is more to the northward, and sometimes blows strong from the eastward for several days; towards the end of the month light land and sea breezes commence; the atmosphere is thick and hazy. In February the land and sea breezes are regular, the latter being fresh near the shore; thick fogs

* The coast being low, is not visible from seaward until a vessel is in about $4\frac{1}{2}$ fathoms at low water, or about 7 miles from the shore. The tides are strong and influence the reckoning to a great extent, and caution is necessary to avoid getting to the eastward of the mouth of the river.

prevail during the whole of the month. In March light land and sea breezes continue, and the weather is foggy. At the period of spring tides the sea breeze is generally strongest.

From December to March the temperature ranges from 71° to 80° in the shade.

The south-west monsoon commences about the middle of April, and after a few days of storm the weather is clear until the beginning of May, when the monsoon fairly bursts, and continues with breaks of a few days of fine weather until the end of October.

To or China Bakir River. For description, see page 297.

RANGOON RIVER (Meyit maka Chaung) rises in the mountainous district of Prome in Upper Burma, in lat. $18^{\circ} 30' N.$, long. $95^{\circ} 50' E.$, and for a distance of 150 miles, flows in a S.S.E. direction nearly parallel to the main stream of the Irrawaddy. At about 50 miles from its mouth it takes a more easterly direction, and under the name of Hlaing river is joined by several large creeks, the chief of which are Panhlaing creek, Pegu river, and Bassein creek. Rangoon river enters the gulf of Martaban in lat. $16^{\circ} 28' N.$, long. $96^{\circ} 20' E.$, after a course of about 200 miles. The land at the entrance is low, and for the most part covered with jungle to the water's edge, forming mangrove and tidal forests, and there is but little cultivation. Owing to the great rise and fall of tide, and velocity of the tidal stream, the water is charged with a large quantity of deposit, causing the river to present a deep yellow hue.*

Land Marks.— Besides China Bakir lighthouse, Lekogon pagodas, four in number, close together, of brown colour, and about the same height as the trees around them, may, with the aid of a telescope, be recognised.

Elephant point obelisk, 116 feet high, of brick, bleached white, marks the western entrance point into the Rangoon river. The point is low with a few tall palm trees near. The square telegraph tower is the only other conspicuous building seen from seaward. There is a flag-staff and a telegraph station on the point in connexion with the town of Rangoon, and vessels can communicate from the outer anchorage, by means of the Commercial code of signals.

EASTERN GROVE LIGHTHOUSE on the point of the same name forming the eastern entrance point to Rangoon river, stands seaward of high water mark, and the lighthouse is similar in structure and colour to China Bakir lighthouse, from which it bears N. $38^{\circ} E.$, distant $17\frac{1}{4}$ miles. From it, is shown at a height of 93 feet above high water a *fixed white* dioptric light of the 3rd order, visible from seaward between the bearings of N.E. by N. round by north to N.N.W. $\frac{1}{4}$ W. for a distance of 12 miles in clear weather.

* The remarks on Rangoon river are adapted to a survey made by the officers of the India Marine Survey, 1884.

Beacon.—A wooden beacon painted red, surmounted by a black basket, stands about half a mile W. $\frac{1}{2}$ N. from Eastern Grove lighthouse, and is used in conjunction with Pilot tree, as a mark, by the pilots. Between the lighthouse and beacon are the ruins of a fallen obelisk.

Pilot Tree with withered branches, stands N. $\frac{1}{4}$ E. distant $2\frac{1}{4}$ miles from Eastern Grove lighthouse. Two baskets coloured black, are fixed in the upper part of this tree.

A beacon with black basket stands near the tree, but a telescope and local knowledge are necessary in order to be sure of recognising Pilot's tree or the beacox near it.

Fairway buoy, chequered black and white, bearing N. 71° E., distant $5\frac{3}{4}$ miles from China Bakir lighthouse, marks the entrance to the Western channel into the Rangoon river, and lies in 20 feet at low water. The eastern side of the channel is marked by black buoys and the western side by red buoys. The deepest water through this channel and over the bar in 1884 (19 to 21 feet) was to be found by keeping about half a mile eastward of the line of the Lower, Centre, and Upper Western buoys, all of which are red.

Pilots.—About 8 or 9 miles eastward of China Bakir lighthouse, the pilot brig (white), with red and white horizontal striped flag by day at the main, will generally be found. A pilot will board any vessel on the usual signal being made.*

* Northward of a line drawn east from China Bakir light a vessel will be in pilotage water. The pilot brings the ship to her appointed place in the port, unless the master desires to remain below the Hastings shoal. The pilot is *ex-officio* officer of customs. The pilot flag has red and white horizontal stripes for a European, and vertical for a native pilot. No vessel need be boarded unless a signal for a pilot is hoisted, in which case it is the duty of the pilot to proceed on board.

Inward Pilotage Rates.—(1883.)

Draught of Water.				Full Pilotage.	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
				Rs.	Rs. As.	Rs. As.	Rs. As.
Below and up to 9 feet	-	-	-	30	7 8	15 0	22 8
9 and up to 10 "	-	-	-	36	9 0	18 0	27 0
10 " 11 "	-	-	-	43	10 12	21 8	32 4
11 " 12 "	-	-	-	51	12 12	25 8	38 4
12 " 13 "	-	-	-	60	15 0	30 3	45 0
13 " 14 "	-	-	-	75	18 12	37 8	56 4
14 " 15 "	-	-	-	90	22 8	45 0	67 8
15 " 16 "	-	-	-	105	26 4	52 8	78 2
16 " 17 "	-	-	-	120	30 0	60 0	99 0
17 " 18 "	-	-	-	140	35 0	70 0	105 0
18 " 19 "	-	-	-	160	40 0	80 0	120 0
19 " 20 "	-	-	-	180	45 0	90 0	135 0
20 " 21 "	-	-	-	205	51 4	102 8	153 12
21 " 22 "	-	-	-	230	57 8	115 0	172 8
22 " 23 "	-	-	-	260	65 0	130 0	195 0
23 " 24 "	-	-	-	300	75 0	150 0	225 0
24 " 25 "	-	-	-	375	93 12	187 8	280 4
25 " 26 "	-	-	-	550	132 8	275 0	407 8

At night, the pilot brig hoists two white lights vertically.

Strangers to Rangoon should invariably take a pilot.

TIDES.—At springs, in the more confined parts of the channel into the Rangoon river, the tides are of great strength, running from 5 to 6 knots *

It is high water, full and change, at China Bakir lighthouse at 1h. 45m., springs rise 16 feet, neaps 11 feet; at Elephant point at 3h. 15m., springs rise 19 feet, neaps 13 feet. At the town of Rangoon, at 4h. 45m., springs rise 19 feet, neaps 14 feet.

The rise and fall of tide given above is for the dry season or from December to March; during the rains at springs, the rise at Elephant point sometimes amounts to 21 and 22 feet. At the town of Rangoon, 21 to 24 feet.

In the Western channel the flood sets north-east along the coast as far as Spit buoy, when it turns gradually to the northward into the river. The great body of the flood passes north-eastward into Sittang river; and in the Eastern channel into the Rangoon river, the flood is comparatively weak, setting to the north-west, and about half an hour later than in the Western channel.

Inside Elephant point in the Western channel, where it is confined by the Middle bank, the flood runs about 6 knots at springs, decreasing in strength as the northern part of the Middle bank is passed.

The ebb tide sets south-east in the Western channel outside or southward of Elephant point, gradually sweeping to south-west as it reaches the southern edge of the Eastern sand. Inside the river the tide generally takes the course of the channel, strong eddies being met with off the various points during spring tides.

The tidal stream is strongest on the night of the second day after full or new moon; it then runs in the channels at the rate of 7 miles an hour, and there is only a few minutes slack water. After neaps the stream gradually increases in strength and continues to run strong, until the moon quarters when it suddenly takes off; on the second and third day after the moon's quartering there is slack water on the flood for $1\frac{1}{2}$ hours, and on the ebb for one hour.

The flood tide at springs makes suddenly and rises 6 feet in the first hour; the ebb stream, however, still continues running in mid-channel and

Outward pilotage is the same as inward up to a draught of 17 feet, above which, it is increased by about one sixth of the above rates.

Except in crossing the Hastings shoal, no vessel within the port of Rangoon may steam, sail, or be towed up with the flood, or down on the ebb, at a greater speed than is necessary to keep the vessel under command.

* After the rains, the tides outside Rangoon river, are subject to a circular motion; the first of the flood sets east, gradually changing to N.E. at half flood, and to north in the latter part of the tide. The ebb sets in the reverse directions, beginning by running west it changes gradually to S.W. and south, ending at S.E. There is no slack water at either tide, the streams continuing to run at the rate of $1\frac{1}{2}$ or 2 knots.—Horsburgh, eighth edition, p. 674.

it is not slack water until one hour after the water has commenced to rise. The flood stream turns earlier in shore than in mid-channel.

In the rains, or the months of June to September, the flood tide is weaker and the ebb stronger than during the remainder of the year, vessels at times not swinging to the flood stream off the town of Rangoon.

When sailing up the channel care must be taken not to be swept on to the narrow ridge of 12 feet which joins the Middle bank and Eastern sands. At half flood, when the banks are covered, the stream after passing the second red buoy runs over Spit sand direct towards Elephant point. The ebb stream sets from the Spit buoy across the channel on to Long sand.

DANGERS.—Eastern and Long Sands extend about 4 miles north and south, by $3\frac{1}{2}$ miles east and west. Portions of these sands dry at low-water spring tides, their highest part being then 8 feet above water. The western edge of these sands is marked by black buoys.

Towards these banks, considerable portions of which dry at low water, the flood tide sets at springs with great velocity, and there is a heavy sea on them during bad weather, but in moderate weather they are not distinctly marked, and as their western edge is steep-to, it is dangerous for a sailing vessel to attempt to enter the channel without a commanding breeze.

Spit Sand, extending to the south-east of Elephant point, is a narrow tongue or spit which dries at low water, and off which shoal water extends into the Western channel in a south-east direction, to a distance of $2\frac{1}{2}$ miles from Elephant point obelisk. A red buoy with basket (Centre Spit buoy), is placed about 4 cables east from the edge of the tongue or spit.

Pilot tree beacon in line with the red beacon near Eastern Grove light-house, clears the Spit sand.

Middle Bank, portions of which dry, at the entrance to the river between Elephant and Eastern Grove points, extends 4 miles in a W.N.W. and E.S.E. direction and is connected by shoal water with the Eastern sands. The south-west edge of the Middle bank is marked by three black buoys (see page 289).

Hmawwun Lump lies 2 miles south of Bassein creek, off the mouth of Hmawwun creek, has 8 feet over it at low water, and is marked by a black buoy, which lies about a cable S.W. of it; the deep water channel lying on the west side. A sand flat extends off the mouth of Hmawwun creek and almost joins Hmawwun lump. Umbrella or North white beacon on east bank in line with Syriam pagoda clears Hmawwun lump.

Da Silva Shoal lies about the middle of the river, the south extreme being $1\frac{1}{2}$ miles north of Bassein creek, and extends $1\frac{1}{4}$ miles north and south, has 5 feet over it at low-water springs, and is joined to the west bank,

the deep water lying on the east side of the shoal. A depth of 10 feet can be carried to the westward of the sand.

Marks to clear Da Silva shoal; when Eastward of the sand, Umbrella beacon open to west of Syriam pagoda.

Choki Lumps, a patch lying between Choki point and Da Silva point, has 9 feet over it at low-water springs and is marked by a black buoy, the deepest water lying on the west side; Choki lumps are joined to Choki point by small lumps, having 12 to 14 feet over them at low water springs.

Marks to clear Choki lumps, Da Silva point in line with New mark, (the northernmost mast with a globe north of Crossing beacon).

Liffey Sand extends from King point, south along the west side of the river $3\frac{3}{4}$ miles, and about half way across the river, the deep water channel being on the eastern side. The highest part is 8 feet above water at low-water spring tides.

Marks to clear Liffey sand, for the lower or southern part, keep the clump of high trees on Pegu river, over Syriam point, but not opening them; for the upper or Northern part, keep Choki and De Silva points well shut in.

Hastings Shoal* lies between the north end of Liffey sand and Monkey point; its extent in a N.N.W. and S.S.E. direction is $1\frac{1}{4}$ miles, and breadth about half a mile; the least water on it at low-water springs is about 4 feet; between Hastings shoal and the north end of the Liffey sand is a narrow channel about $1\frac{1}{2}$ cables wide, with 7 to 8 feet least water in it at low-water springs. The deeper channel with 14 feet at low-water springs for entering the port of Rangoon, lies between the north end of Hastings shoal and Monkey point; the eastern edge of Hastings shoal is marked by two red buoys.†

To clear Hastings Shoal, pass the two red buoys marking the eastern edge, on the port side. The leading mark for clearing the northern edge of the shoal, is the sheer legs on Port-office wharf, open to the north of the mill chimney on Mill point (which point lies on the opposite side of the river to the Port-office wharf); these marks must be opened slightly in approaching Monkey point.

Caution.—The Northern channel is very narrow and the shipping in the port of Rangoon make the leading marks very difficult to recognise, the more so, as the turn round the elbow of Hastings shoal is sharp and the tide runs strong.

Alun Sand lies off the western end of the town of Rangoon, and extends from the north shore, three quarters of the distance across the river,

* See plan of port of Rangoon on Admiralty chart, No. 833, scale, $m = 3.3$ inches.

† In October 1886, H.M.S. *Ranger* reported the shoalest part of Hastings shoal to extend about one cable in a south-south-easterly direction, from the southern red buoy, marking its eastern edge. Here the depth found was only 2 feet at low water springs.

the channel lying between the sand and the south bank of the river. The town flagstaff in line with the extreme of Mill point clears the south end of Alun sand.

BUOYS.—Western Channel.—Besides the Fairway buoy (chequered black and white) described at page 285, the following are placed at the entrance of the Rangoon river.

Lower Eastern buoy, black, with staff and ball, in 18 feet at low water, bears from China Bakir lighthouse S.W. by W. $\frac{1}{4}$ W. (westerly), and Eastern Grove lighthouse N. by E. $\frac{1}{4}$ E.

Centre Eastern buoy, black, in 18 feet, bears from Elephant point obelisk S. by E. $\frac{3}{4}$ E., and from Eastern Grove lighthouse S. by W. (westerly). **Upper Eastern buoy**, black, with staff and triangle in 20 feet, bears from Elephant point obelisk S. 50° E., distant $3\frac{1}{10}$ miles.*

Lower Western buoy, red, in 19 feet, bears from Fairway buoy N. 44° W., distant $2\frac{6}{10}$ miles.

Centre Western buoy, red, in 21 feet, bears from Elephant point obelisk S. 16° W., distant $6\frac{6}{10}$ miles.

Upper Western buoy, red, in 21 to 22 feet, bears from Elephant point obelisk S. 4° E., distant $4\frac{1}{2}$ miles.

Eastern Lump buoy, black, in 24 feet, bears from Elephant point obelisk S. 57° E., distant $2\frac{9}{10}$ miles.

Lower Spit buoy, red, in 24 feet, marks the eastern of the Spit sand, and from it Eastern Grove lighthouse bears N. 21° E., and Elephant point obelisk N. 31° W.

Centre Spit buoy, red, with staff and basket, lies in 35 feet with Eastern Grove lighthouse bearing N. 24° E., and Elephant point obelisk N. 50° W.

Upper Spit buoy, red, in 23 feet, marks the edge of the spur of sand extending between Elephant point and the Centre Spit buoy; from it Eastern Grove lighthouse bears N. 52° E., and Elephant point obelisk N. 78° W.

Lower Middle Bank buoy, black, in 20 feet, bears from Elephant point obelisk N. 61° E., distant $1\frac{9}{10}$ miles.

Centre Middle Bank buoy, black, in 16 feet, bears from Elephant point obelisk N. 36° W., distant one mile. It marks the centre of the south-west edge of the Middle bank.

* Owing to rust, the black buoys at times appear red, caution is therefore necessary. In March 1885, it was intended to move the Upper Eastern buoy 850 yards S.S.W. of its present position, to indicate the extension of the Eastern sands which had taken place.

Upper Middle Bank buoy, black, in 19 feet, bears from Mibya pagoda S. 26° W., distant $2\frac{1}{2}$ miles, and lies near the western edge of the Middle bank.

The channel between the buoys varies from $4\frac{1}{2}$ cables to $2\frac{1}{4}$ miles in width, the narrowest places being near the centre Spit buoy where it is about 6 cables wide, and between Elephant point and the south edge of the Middle bank, where it is only $2\frac{1}{2}$ cables in width. The least water on the bar near the Outer buoy is 18 feet at low water ordinary spring tides during the dry season (from December to April).

Buoys inside the River.—Eastern channel has no buoys, and the pilots are not permitted to use it.

Hmawwun Lump Buoy.—Black, lies in 16 feet of water; from it, the small pagoda in the village on the south side of the entrance of Bassein creek bears N. 31° W. about $2\frac{1}{4}$ miles, and the southern extreme of the north point of entrance of Hmawwun Chaung bears N. 79° E., 1 mile $3\frac{1}{2}$ cables. It marks the south-west end of an 8-foot patch called Hmawwun Lumps.

Choki Lumps Buoy.—Black, lies in 19 feet; from it North beacon (Umbrella) bears S. 61° E. $1\frac{3}{10}$ miles, and Choki point beacon N. 2° E. about 9 cables distant. It lies near the south-west end of Choki Lumps.

Lower Hastings Shoal Buoy.—Red, lies in 21 feet of water; from it, Syriam pagoda bears S. 75° E. about 3 miles 8 cables distant, and the left extreme of Syriam point N. 27° E. It marks the eastern edge of Hastings shoal.

Upper Hastings Shoal Buoy.—Red, in 14 feet; from it Lower Hastings shoal buoy bears S. 17° E. about $8\frac{1}{2}$ cables distant, Dallá pagoda S. $82\frac{1}{2}^{\circ}$ W. distant about $2\frac{4}{10}$ miles, and Shwe Dagon pagoda, N. 57° W. about $3\frac{8}{10}$ miles distant. It marks the north-east end of Hastings shoal.

Syriam Flat Buoy.—Black, in 15 feet; from it Upper Hastings shoal buoy bears S. 41° W. about $2\frac{1}{2}$ cables distant, Lower Hastings shoal buoy S. 4° E. about a mile distant, and Dallá pagoda S. 78° W. distant about $2\frac{6}{10}$ miles.

Wreck.—A small green buoy in 14 feet at low water, near the west end of the Monkey point channel, marked, in 1884, the position of a wreck.

ENTERING THE RIVER.—Vessels of more than 15 feet draught should not attempt to enter the river on the ebb tide. Vessels at the outer anchorage waiting to proceed to the port of Rangoon should

weigh at slack water, and enter the river on the first of the flood stream, when the water will have risen from 3 to 6 feet on the bar.

Commanders of vessels possessing no local knowledge should not attempt, unless under exceptional circumstances, to pass to the northward of the Fairway buoy without a pilot.

The mouth of the river becomes distinguishable by means of Elephant point obelisk on the west bank, and Eastern Grove lighthouse on the east bank. From the Fairway buoy, which is in 20 feet at low water, the mid channel course is N.N.E. $\frac{1}{2}$ E. until past the upper Western (red) and centre Eastern (black) buoys, then if Pilot Tree beacon (on the plain, north of Eastern grove lighthouse) can be seen, keep it a little to eastward of Red beacon on a N. by E. $\frac{1}{4}$ E. bearing. This will lead a vessel about 2 cables eastward of Lower spit buoy (red), and about mid-channel between Centre spit buoy (red with staff and cage) and Eastern lump buoy (black with staff and cage), now alter course to about N.N.W. $\frac{1}{2}$ W. or with Upper Eastern buoy seen astern, midway between Eastern Lump and Centre Spit buoys, and so continue passing between Upper Spit and Lower Middle bank buoys, and when Motjua beacon (red, on west bank) opens east of Elephant point, steer for it on a W. by N. $\frac{3}{4}$ N. bearing, and pass Elephant point at about $1\frac{1}{2}$ cable's distance from the bank.

Care must be taken not to pass too far to the eastward of Elephant point as a vessel would be in great danger of grounding on the shoal tail of the Middle bank, the channel here being only $2\frac{1}{2}$ cables wide.

After rounding Elephant point steer along the western bank of the river at about 2 cables from it, until the small red brick pagoda, on the south point of the entrance to Bassein creek, is seen. On nearing the above-mentioned pagoda, two white beacons, similar in shape to that at Motjua, will be seen on the opposite shore northward of Bassein creek; Keikmalong clump of teak trees (in which is a remarkable gap) will also be seen inland, to the south of the beacons. Keeping this clump open to the southward of the south white beacon, on a N.E. bearing, cross over to the opposite shore, steering then along the eastern bank of the river not more than $1\frac{1}{2}$ cables from the shore. The mark for preserving this distance is to bring the pole with red basket, situated just south of the North white beacon, in line with Syriam pagoda.

From South (Crossing) Beacon* to Choki Point.—

Keep pole with red basket in line with Syriam pagoda (this leads a vessel to the eastward of Da Silva shoal until Choki point comes nearly in line with, but eastward of, Shwe Dagon (the great pagoda north of Rangoon); steer with this mark just open bearing N.W. $\frac{1}{2}$ N. until abreast

* The South Beacon is now opposite Bassein creek, 7 cables south of its old position, and is close to the high water line. (Commander A. Carpenter, R.N., April 1886.)

Akalon chaung, a creek near Choki point, keeping a cable distant from the bank while passing between the black buoy on Choki Lumps and Choki point beacon (mast with black basket).

To pass on the west side of Choki Lumps;* after passing upper White beacon (Umbrella) steer across the river passing close to the northward of Da Silva point and bring Da Silva point in line with New mark† (mast with black basket) until nearly abreast of Choki point; then close the east bank to 2 cables.

From Choki Point to Rangoon.—Keep near the east bank about 2 cables distant, taking care not to open the distant clump of high trees on the northern bank of Pegu river,‡ to the west of Syriam point, at the lower part of the reach; and keeping Choki point and Da Silva point shut, in the upper part of the reach, (this keeps a vessel clear of the Liffey sand) until abreast of the Southern buoy (red) on Hastings shoal, then steer to pass Hastings shoal buoys (red), leaving them to port, and when the sheer legs on Rangoon town side come nearly in line with Mill chimney on the point on opposite side of the river to Rangoon town, steer with that mark just open (caution is necessary here on account of the tide and sharp turning) until abreast Monkey point battery, then open the marks more by keeping out towards the middle of the river, when a vessel must anchor if not boarded by a harbour master.§

Caution.—The description of the different beacons along both sides of the river bank, is given as they were found, during the stay of the *Investigator* from December 1883 to April 1884. Details of the various descriptions of the buoys, excepting in the matter of colour, have not been stated, as it was contemplated to alter them in accordance with Indian Government regulations as to buoyage.

The above general directions for the river above Elephant point are given in case circumstances may arise rendering it necessary for a vessel to proceed towards Rangoon without a pilot.

Inner Navigation.—For remarks on the navigation of the Irrawaddy above Rangoon, *see* pages 294 and 360.

RANGOON, the chief export town in Burma, is 21 miles from sea by the course of the river. The principal part of the town and

* Choki Lumps are liable to change at different seasons of the year, but not to any great extent.

† New mark is a mast with black basket; care must be taken that this mark is not mistaken for the one to the southward of it called Mack's mark which also has a black basket.

‡ The clump of high trees is beyond the limit of the chart, and the mark given is a tacking one, used by pilots, *see* sketch (b); the best course up this reach, is close to the Eastern bank, about 2 cables distant from it.

§ Letter P of the Commercial Code is the signal for the harbour master, and should be hoisted on reaching Hastings shoal. Commander A. Carpenter R.N. 1886.

the military cantonments are on the left bank of the river ; but large timber yards and factories are built on the opposite (Dalla) shore, and the town there is fast rising in importance. The principal buildings are the public offices on the Strand, the Municipal market, and English church ; but the most conspicuous object in Rangoon is Shwe Dagon pagoda, 487 feet above high water, and gilded from base to summit : there are also several other pagodas in the town and neighbourhood, that at Syriam, 6 miles to the south-east of the town, being the next largest. The town is well laid out and clean. A large portion of the population are Chinese. There is no dry dock, but slips have been built on which vessels of 500 tons can be taken up. Repairs to machinery can be effected at the factory of the Irrawaddy Flotilla Company. There are several fine wharves for vessels to discharge cargo at, and spacious warehouses (godowns) along the river side. There is good anchorage off the town of Rangoon for vessels of any size. The limits of the port of Rangoon are marked by boundary pillars.

Trade.—The chief exports are rice, teak, and cutch. The rice season commences about the end of January. In 1883 the number of vessels visiting Rangoon was 2,154, representing a total tonnage of 1,288,696. In the same year 535,663 tons of cargo were imported and 753,033 tons exported. There is a moderate trade in timber throughout the year to Bombay and Europe, and a general trade with the Straits Settlements. There is a weekly mail service between Calcutta, Akyab, and intermediate ports, a fortnightly mail to the Straits Settlements, and telegraphic communication with Calcutta, Bassein, Akyab, and Prome.

Inland Communication is chiefly by water. There are two railways in the Province, the Irrawaddy valley and Sittang valley. The former leading to Prome (163 miles) was opened in 1877. Tramways and sidings connecting with the railway, are brought along and to the extremities of the various wharves, of which there are four on the Rangoon town side of the river, and numerous small landing stages.

Steamers run twice a week from Rangoon to Bassein ; and from Rangoon to Mandalay. There is also bi-monthly communication by the same means with Bhamo about 800 miles from the sea, and this is considered to be the limit of navigation by steam vessels.

Supplies.—Fresh provisions are neither plentiful nor good ; beef is inferior, and mutton difficult to obtain at any price ; but vegetables and poultry may be obtained at reasonable prices. Water is brought alongside at 3 rupees (about 5s.) a ton, and coal at 20 rupees (about 1*l.* 15s.) a ton.

Tides.—It is high water, full and change, at the Master Attendant's wharf at 4 hrs. 45 min. : springs rise 19 feet, neaps 14 feet, during the dry season, December to April ; but during the rains, the rise at springs is

increased to from 21 to 24 feet. The velocity of the stream at springs, is 5 to 6 knots.

PEGU RIVER, which joins Rangoon river just below the town of Rangoon, rises in the Pegu Roma mountains, and after a S.S.E. course of about 50 miles to Pegu, where it is spanned by a bridge, trends for another 53 miles to Rangoon. On the east it communicates with the Sittang by several channels, that of Paing-kiwon forming a canal between the two rivers. A new canal striking the Sittang at Myitkyo is being constructed. A bore with a crest about three feet high sweeps up the Pegu river, in the months of February, March, and April, and its effects are felt at Pegu. During the rains steam navigation is carried on in connexion with Toungoo (Taungú).

Pazundaung Creek, after a S. by E. course of about 53 miles, also joins the Rangoon river just below the town of Rangoon, where its mouth is about 440 yards in width. Thirty-five miles above Rangoon it is 50 feet broad, and flows between high banks with a depth of 3 feet during the dry season, and a tidal rise of $1\frac{1}{2}$ feet. Towards its mouth, the banks are steep and muddy. Boats ascend for about 40 miles.

INNER NAVIGATION.*—The River Irrawaddy is full of islands and sandbanks, many of which are submerged during the rains, and the eastern bank then suffers from inundations. The river is navigable at all seasons by steamers drawing 4 feet, as high as Bhamo, or some 800 miles from the sea; and during the dry season for steamers drawing 6 feet as far as Thayetmyo. See page 297. In the rains, steamers and large boats enter the main stream of the Irrawaddy from Rangoon by the Panhlaing or Bawle creeks; but during the dry season they have to descend the Rangoon river for some distance, and, passing through the Bassein creek, enter the Irrawaddy through the inner part of the To or China Bakir river.†

From Mandalay in lat. 22° N. to the junction with the China Bakir river in lat 17° N. the general width of the Irrawaddy varies from 500 to 3,000 yards. The banks are in general wooded and well defined. No rules can be laid down for the best channels, as changes frequently take place, but the pilots are intelligent and trustworthy. Two miles below Akauktaung on the right bank of the river, is a remarkable cliff, covered with images of Buddha carved out of the rock. It is about three quarters of a mile in length and rises 400 feet sheer out of the river. This is the first high land met with when ascending the river. Here the current runs

* For information from Commander A. Carpenter, India Marine Survey, 1886, see Appendix, page 360.

† See Admiralty charts:—Bay of Bengal, east coast, Koronge island to White point, No. 823; and Irrawaddy river, sheets I. and II., Nos. 2,135 and 2,136.

with great strength, as much as $7\frac{1}{2}$ knots having been experienced in August.*

In July 1881, H.M.S. *Ready* drawing 10 ft. 2 in. water ascended the river from Rangoon to Thayetmyo. The track pursued was that leading through Panhlaing creek, which joins the main river at Yandún, about 60 miles above Rangoon. When descending the river, Rangoon was reached through the To or China Bakír river and Bassein creek. The navigation of the main stream in the month of July was found easy, and there was sufficient water in it for a vessel drawing 15 feet.

Routes.—To reach the main river from Rangoon, the route by Panhlaing creek is recommended when ascending the river, as it is 67 miles shorter than the Bassein creek route, and carries 6 feet more water; the creek is, however, narrow and intricate, and at the point of junction with the main stream the navigation is so difficult that none but steam vessels fitted either with twin-screws or large additional rudders could turn. Panhlaing creek is not used by steam vessels when descending the river on account of the difficulties and frequent accidents incidental to this point.

The route by China Bakír river and Bassein creek is that used by large steam vessels on their downward trip, being much less obstructed than Panhlaing creek, and having almost always a sufficient depth of water for vessels drawing not more than 6 feet, at high water neaps. A vessel drawing more than 6 feet can only be certain of getting through Bassein creek at spring tides.†

The *Ready* drawing 9 ft. 9 in. passed through Bassein creek on the flood one day before spring tides; for a distance of several miles there was not more than her own draught of water, but the mud was so soft that the vessel never brought up, though steaming as slowly as possible, through the shallower parts. It is said that by carefully judging the time of entering this creek a depth of 12 feet may be depended upon, but the difficulty of so judging renders vessels of more than 10 feet draught liable to be detained.‡

* Remark book of Commander W. R. Clutterbuck, H.M.S. *Woodlark*, 1885.

† It is high water 50 minutes earlier at the west end of Bassein creek, than at the eastern entrance. During the last quarter of the flood and first hour of the ebb, the stream runs to the westward throughout the creek. After that, however, the streams separate and flow out of both ends. (Remarks by officers of H.M.S. *Woodlark*, 1885.)

‡ The Irrawaddy Flotilla Company's steamers, which use the Bassein creek in their voyages to and from Rangoon town, anchor near the Fort, just inside the Bassein creek, which is about half a mile broad there. The creek dries in many places at low water, but by entering at the proper time of tide, a vessel drawing 8 feet can get through without stopping, as the tide appears to separate about half way through, so that if a vessel entered with the flood at either end, and proceeded as the water rose over the shoal parts, maintaining a moderate speed 5 or 6 knots, she would leave the other end with first of the ebb.—Lieut. E. C. H. Helby, R.N. 1884.

H.M.S. *Woodlark*, however, which vessel passed through Bassein creek on the 11th August 1885, one day after new moon, found the least depth of water to be 16 feet (near its south-west end). The *Woodlark* entered from the Rangoon river, $2\frac{1}{4}$ hours before high water at Elephant point and her speed was estimated at $7\frac{1}{2}$ knots per hour. After entering the China Bakir river, a depth of not less than 4 fathoms was found near the left bank as far as Dayage. The strength of the current was ascertained to be $3\frac{1}{4}$ knots, and the least depth of water found between Dayage and the junction with the main river, was 25 feet.

There are two other routes from seaward up the Irrawaddy river, namely, that leading through Bassein river and Thamadine creek, and that through the entrance to the Irrawaddy proper, which enters the sea at a few miles west of Krishna shoal. Of these routes, Thamadine creek which is always used by the river steam vessels, is narrow and intricate, but has a depth of 3 fathoms, it joins the main stream at a little below Henzada, about 120 miles above Rangoon. The Irrawaddy proper is said to be the straightest and best channel to the sea, having a depth of 12 feet on the bar at low-water springs; it is, however, not at present (1885), used, as there is no town near the entrance.

Up-River Pilots.*—The *Ready*, both up and down, was accompanied and generally preceded by the India Government steam vessel *Irrawaddy*; pilots belonging to the Irrawaddy Flotilla Company were employed in both vessels, and found trustworthy; the frequent fluctuations of the river can only be followed by the constant observation of local pilots, who are each qualified for districts about 60 miles long. The pilots are mostly Chit-tagongese.

Current.—The average current experienced when above tidal influence was 3 knots an hour, but at some points it attained a velocity of between 5 and 6 knots.

Rise of River.—The tide is felt as far up as Henzada, about 120 miles above the town of Rangoon. In March the river commences to rise, steadily increasing in June, and attaining its maximum height in September, at which time it is at Prome, about 34 feet above its dry season level. The *Ready* reached Thayetmyo after the first rise of the river, which at the time of her arrival (7th July) was 7 feet below the mean high level. During a stay of 13 days it fell from 7 to 8 feet, but commenced to rise again on 20th July. In 1877 the river is reported to have risen 9 feet above the mean high level, that being the highest rise recorded. The rise varies, being sometimes greater at Prome than at Thayetmyo, 50 miles above; but generally it decreases below Prome and increases above that place. (See Appendix, page 367.)

* Masters of Irrawaddy Flotilla Company, pilot their vessels as far as Dorabyu; thence to Bhamo, the local pilots are employed.

At Thayetmyo the river is about 3 miles broad and the bank, as a rule, so steep that vessels can lie sufficiently near to admit of hauling a boat to and fro by a line; care, however, should be taken lest the copper be rubbed by snags, projecting from the bank at a few feet below the water.

Up-River Trade.—The Irrawaddy Flotilla Company with headquarters at Rangoon, owning about sixty vessels, maintain the great bulk of the trade, which is estimated roughly at about one and a half millions sterling, either way; or in 1877, imports into Upper Burma 1,417,209*l.*, into Siam 63,675*l.* Exports, respectively to the same countries at 1,321,970*l.* and 267,791*l.* The following are the stopping stations between Rangoon and Mandalay. Up stream, Yandún, Donabyu, Henzada, Yei-king, Myanaung, Prome, Thayetmyo (military station), Minhla, Magwe, Yenangyaung, Sinbugyan, Nyaungu, Kuniwa, Pokoku, and Mandalay, about 350 miles above Prome.

The chief articles carried up stream are piece-goods, rice, salts, hardware, and silk. The down stream cargo consists of raw cotton, cutch (for dyeing), india-rubber, jade, spices, precious stones, timber, earth-oil, and cereals. The steamers stop on the downward voyage at Letsambu and Tsagine, in addition to the up-stream stopping stations.

TO OR CHINA BAKÍR RIVER disembogues through extensive flats of sand and mud, about 4 miles to the southward of China Bakír Lighthouse, and though not so deep as the mouth of the Irrawaddy proper (said to have 12 feet at low water on its bar), in case of emergency might be made use of.

The coast is well wooded, but the entrance to the river, though indistinct, may be made out by the long compact clump of dark trees on its eastern side, the western end of which, from seaward, appears abrupt. To the eastward of this clump the trees are less compact and occasional large gaps appear. About half a mile inside the eastern point of the entrance is a small fishing village, and about the same distance from the village is Mengalon creek, by which boats can proceed to the town of Mengalon, about a mile inland.

Both banks are lined with mangroves, and about $2\frac{1}{2}$ miles from the eastern entrance point, or about 8 miles from the 3-fathom line outside the shoals, the river forks—one branch, the Bassein creek leading in a north-easterly direction, into the Rangoon river. The other branch, which just inside the fork is partially blocked by an island and shoal water, leads in a north-westerly direction.

DIRECTIONS.—The channel through the sand banks which obstruct the entrance to the China Bakír river is very narrow at its outer end, and although a vessel of 15 feet draught can enter by careful navigation at high-water spring tides—it should not be attempted without having previously carefully marked the channel, and until that is accomplished she

should remain at anchor in about 18 feet at low-water springs, with China Bakir Lighthouse bearing N.E. $\frac{1}{4}$ N. distant 5 miles; from this position which is $2\frac{1}{2}$ miles from the narrows, and about one mile from the 2-fathom line, the village should be seen just open west of the west extreme of the long compact clump (N. 19° W.) on the eastern point of the river entrance; and this is a good general guide for finding the passage through the shoals, for the purpose of buoying or staking it, but not for entering by alone.

After passing the narrows, the depth of water rapidly increases and a N.N.W. $\frac{1}{4}$ W. course, keeping on the eastern side of the river, will lead to the Fork.

If proceeding to the north-westward, the deep water channel is on the northern side of the island situated above the fork, and a vessel after passing close to the point, at which the coast trends away to the north-eastward into the Bassein creek, should steer across the mouth of the Bassein creek, keeping slightly to the eastward until the centre of the channel is open, when she may enter, avoiding the extensive mud bank which extends off the south-east end of the island, by keeping near to the northern shore. There is a small bank also off the northern point of the channel entrance, but of no great extent, and steep-to.

SITTANG RIVER.—The coast eastward of the entrance to the Rangoon river is low, and bordered by an extensive shallow bank of mud and sand, which prevents its being approached in a large vessel. Sittang river at the head of the gulf of Martaban, has a wide bell-shaped mouth, and as there are no charts of its channels, it is only entered by local trading craft. The Sittang rises in the hills of Upper Burma, about 130 miles above Toungoo (Taungu). Above the town of Sittang (Tsit-taung), from which it derives its name, the current is so strong that this part of the river is scarcely navigable by the large native boats. During the rains communication with Moulmein (by boat) is kept up through the Weng-ba-daw creek, the entrance to which is about 7 miles below Sittang town. By the inhabitants of the villages on either bank, Sittang river is sometimes called the Paung-laung and sometimes the Toungoo (Taungu) river. On the eastern side of the entrance to Sittang river, are the Zingyaik mountains about 9 miles inland from the coast; these extend in a north-east and south-west direction, and have several pagodas on their summits, the northern of which is the highest. The Zingyaik mountains are sometimes visible for a distance of 45 miles, but are of little aid to navigation, being too far inland.

A bore or tidal wave sweeps up Sittang river at spring tides; following its crest, and said to be as dangerous as the bore itself, is a heavy

chopping sea of sand and water. The Sittang has an enormous quantity of silt suspended in its water.*

TIDES.—On the coast of Pegu the tides run strong. Westward of the Baragua flats the flood sets East and E. by N., and the ebb in the contrary direction. From the Baragua flats to Rangoon river entrance, the flood sets N.E. and N.E. by N. and the ebb to the south-west.† Between Rangoon river and the coast of Martaban the flood runs strongly by N.N.E. and N. by E. into the Sittang, and the ebb with equal strength out of it. During and immediately after the south-west monsoon, the ebb tides are much stronger and run longer than the flood tides. Abreast the Baragua flats and farther westward the velocity of the tide (especially the flood) is not so great as farther to the eastward.

Rise of tide.—On the west part of the coast of Pegu, off the mouth of the Bassein river, the rise at springs is only 9 to 10 feet; off the China Bakir river entrance the rise during the dry season is from 14 to 16 feet at springs, and off Elephant point to 19 feet, but this increases during the rains probably to 18 feet at China Bakir lighthouse, and to 21 feet at Elephant point. The tides should be studied, especially if found necessary to anchor, to avoid selecting too shoal a position at low water.

BALUGYUN (Bheloo Gywon).—The coast on east side of entrance to the Sittang is low, and trends S.S.E. to the entrance of the Martaban river or northern mouth of the Salween, between which and the Moulmein river, or southern mouth, lies the island of Balugyun, 17 miles in length north and south, by 8 miles in width. A range of wooded hills with pagodas on some of the peaks extends north and south throughout the centre of the island. The north and south ends of Balugyun island are higher than the centre, and have upon them thick clusters of trees. A pagoda surmounts the southern hill immediately over the south point of the island, and is a good mark in approaching Moulmein from the westward.

The western shore of Balugyun island should be given a wide berth when approaching from the northward, to avoid the shallow ground extending from it.

MOULMEIN or SALWEEN RIVER (Than-lweng), the source of which is said to be amongst the mountains eastward of Assam in about lat. 28° N. After traversing Yunnan, and the Shan and Kareng-ni states to the south of that province of China, it enters British territory and for some distance, as far as the mouth of the Thaung-yeng (one of

* *Imperial Gazetteer of India*, vol. IX., p. 140.

† After the rains the tides off Rangoon river are subject to a circular motion. See page 286, foot note.

its tributaries), forms the eastern boundary of Burma. In this part of its course it is a broad stream flowing swiftly between high densely wooded mountains, and navigable by boats. Near the Thaung-yeng, the stream is in some places not more than 30 yards wide.

Ten miles below the mouth of the Thaung-yeng are the great rapids, formed by a bridge of rocks which extend completely across the river. These rapids in the dry season are impassable, even for canoes. Ten miles below are other less formidable rapids, but impassable in the rains. Below these lower rapids the river is encumbered by numerous islands and shoals, which are covered in the rains, when the water rises about 30 feet. A few miles further south it receives the waters of the Rwonzaleng from the westward, and hereabouts the hills on the eastern bank recede, those on the western diminish considerably in altitude, and the river traverses a more open and level country. Limestone rocks, rising suddenly out of the plain into serrated lofty ridges, appear on both banks at intervals.

At Moulmein* the river receives from the eastward the Gyaing, formed by the junction of the Hlaing-bhwai and the Haung-tharaw, and the Ataran which joins the Gyaing at its mouth. It here splits and enters the sea by two outlets, the northern of which (in lat. $16^{\circ} 27' N.$, long. $97^{\circ} 25' E.$) is known as Martaban or Darebauk river. This outlet was formerly the principal entrance, but it is now filled with small islets and sand banks. On its right bank, and opposite the town of Moulmein, is the town of Martaban, from which this mouth of the river, as well as the gulf, takes its name. The southern outlet, commonly known as Moulmein river, is, though intricate, navigable for vessels of considerable draught as far as Moulmein. The entrance to this mouth of the Salween is 18 miles south of the Martaban outlet.†

AMHERST POINT‡ the south entrance point to Moulmein river, terminates in a bluff point about 13 feet high; the shore southward being composed of low cliffs covered with brushwood, with a foreshore of sand and scattered rocks. On the extreme point are three pagodas close together and a conspicuously tall palm tree; a short distance from the pagodas are a telegraph station and signal staff. Immediately below Amherst point, on a high rock which is surrounded by water at high tide, is the Water pagoda; and on the rocky point, three-quarters of a mile to the southward, is another pagoda.

* The information relating to Moulmein or Salween river is the result of a survey by Navigating Lieutenant F. W. Jarrard, R.N., surveying vessel *Clyde*, 1878.

† See Admiralty charts:—Bay of Bengal, sheet 3; Koronge island to White point, including the gulf of Martaban, No. 823; Moulmein river and Amherst road, No. 1845.

‡ See Admiralty plan of Moulmein harbour, No. 1646; scale, $m = 2.97$ inches. Also, No. 1693 of River Salween, scale, $m = 0.94$ inches.

THE COAST for several miles southward continues in a succession of sandy beaches, separated by rocky points at the termination of spurs from Tsheng Taung, a thickly wooded peak 950 feet high about $4\frac{1}{2}$ miles to the south-east of Amherst and which is the most conspicuous feature of the country in the vicinity. The foreshore of sand and mud interspersed with patches of rock, extends from one cable near the points, to 5 cables, from high water, and isolated rocks are scattered about outside low water line. The country is thickly wooded, and appears from seaward to be covered with jungle, which on the more elevated ground becomes forest-like in appearance.

Green Island, a small islet, about a quarter of a mile in length and 200 yards wide, lying S.S.W., one mile from Amherst point, is about 30 feet high and is covered with trees and brushwood, which at the highest part of the island forms a clump. The island is surrounded by rocks and large boulders which uncover for a considerable distance at low water spring tides; and patches of rock at low water nearly connect the island with the coast, leaving a channel which can only be used by boats; this channel is generally filled with large fishing stakes. The west side of the island should not be approached within a quarter of a mile, as a bank of mud and several rocky pinnacles extend off its north-west point, and between the island and Amherst point the bottom is rocky and uneven.

Long Stones Reef.—From Amherst point a reef of rocks consisting of isolated groups, with deep water between them, extends in a narrow line $1\frac{1}{2}$ miles in a north-west direction. The highest rocks of this reef uncover at about half tide: thus when the rocks are covered, the tide has risen over 11 feet. Other patches of rocks and shoal water lie on the south side of the reef. Through the passages between the rocks the tide rushes with great violence, forming heavy overfalls, especially on the ebb tide. A black buoy, known as the Reef buoy, lies in 30 feet at the extremity of Long Stones reef.

The Patch, on which there is a depth of 9 feet, lies 5 cables S.W. from the extreme point of Long Stones reef. A black buoy with staff and ball lies in 40 feet, $1\frac{1}{2}$ cables to the westward of the patch.

THE MOULMEIN MOUTH OF THE SALWEEN extends from Amherst point northward to the south point of Balugyun island, between which it is $9\frac{1}{2}$ miles wide; but the navigable channel, which is close to the Amherst shore, and immediately north of the Long Stones reef, is narrowed to only 4 cables by extensive banks of sand which fill up the mouth of the river.

Balugyun Sands, the largest of the above-mentioned banks, is $4\frac{1}{2}$ miles long by $2\frac{3}{4}$ miles wide; its sea face lying in line with the coast

nearly north and south across the mouth of the river; it is steep-to on this the west side, there being from $7\frac{1}{2}$ to 9 fathoms at low-water at from 7 to 5 cables from the sand. Further seaward the water shoals to $6\frac{1}{4}$ fathoms, leaving close to the edge of the sands a deep channel, apparently caused by the main tidal stream of Sittang river taking this direction and preserving the steep sea face of the sand. North of this large mass of sand is a channel, navigable only for boats, which separates it from Balugyun. The last of the ebb tide rushes through this narrow outlet with great velocity, as the water lower down (confined by high sand banks as far as the main outlet at Amherst) is met by the flood tide there $1\frac{1}{2}$ hours earlier than at Balugyun.

Goodwin Sand, a detached bank, about $2\frac{1}{4}$ miles long in an east and west direction and three-quarters of a mile wide, lies south of Balugyun sands, from which it is separated by a channel in which there is a depth of only 2 feet at low water.

South Goodwin Knoll, a small patch of sand which dries at low water, lies S.E. nearly $1\frac{1}{4}$ miles from the south-west edge of the Goodwin. A red spiral buoy, lies in 24 feet close to the south edge of Goodwin knoll.

Entrance.—The entrance to Moulmein river, $2\frac{1}{2}$ cables wide, lies between Goodwin buoy (marking the south edge of Goodwin sands) and Reef buoy (marking the extremity of Long Stones reef). A spit, over which there is a depth of only 21 feet at low water, projects westward and southward from South Goodwin knoll; vessels of heavy draught, when entering, should therefore approach the entrance from the southward, and steer to pass about a cable west (outside) of the Patch buoy, and then, according to the strength of the tide, head up N.E. or about three quarters of a point westward of Goodwin (red) buoy and when the reef buoy (black) bears E.S.E., steer to pass about half a cable southward of the Goodwin buoy. If entering the river at spring tides some time after the flood tide has made,—or, as most large steam vessels do, when Long Stones reef is covered,—great care is necessary, as the tide eddies and whirls in all directions near the entrance, and sets strongly on to the reef. There is no leading mark for entering the river; the navigator is therefore warned to keep the lead going, and use the utmost caution in passing through this dangerous entrance.

A sunken reef* having a depth of 9 feet over it, at low water springs, was discovered in the entrance to Moulmein river in 1878, lying about $1\frac{1}{4}$ cables W. by N. from the Amherst reef buoy, with the Water pagoda bearing S.E. $\frac{1}{2}$ E., the west extreme of Green island, S.S.E. $\frac{1}{4}$ E., and the patch buoy S.W. Westerly. Vessels are cautioned against entering or leaving the river until Amherst reef is covered.

* Attempts have been made to remove this reef by blasting, but without success (Port Officer, Moulmein, November 1886).

Ann Rock.—In the deep channel, $1\frac{1}{4}$ miles E. by N. $\frac{1}{2}$ N. from the extreme of Long Stones reef is Ann rock, the shoalest water on which appears to be 13 feet; this rock consists of three pinnacles, close to each other. A black spiral buoy is moored in 15 feet on the rock.

BALUGYUN CHANNEL.—Inside the entrance the channel widens considerably and takes a general north-easterly direction for 3 miles, it then divides into two channels; the main stream, abruptly turning to the northward and flowing along the eastern edge of the Goodwin and Balugyan sands, is named the Balugyun channel. The other, known as the Old channel, takes a more easterly direction along the low shore which forms the left bank of the river. Balugyun channel being the deepest, is that used by vessels of large draught; it is well buoyed, but as there are so many buoys in the channel, a description of them would tend only to confuse the navigator, who must rely on the pilot's knowledge of the river. The depths in the channel vary considerably, from 27 feet in the lower to 15 feet in the upper part. At one mile from the Balugyun shore the channel abruptly crosses the river and takes the left bank just above a white wooden beacon situated on the edge of the bank. This part of the river is known as the New channel, and is one of the shoalest, having only 11 feet in some parts at low water spring tides. From abreast the beacon before mentioned, the channel northward deepens considerably and is close to the bank of the river, which is steep-to.

Old Channel though still used, appears to be gradually silting up, as there is only 5 feet at low water in the lower part of the channel. The advantage of this channel for sailing vessels is that it is more protected from the heavy sea, which in the south-west monsoon at high water rolls over the sands into Balugyun channel.

Middle Flats dividing Balugyun and Old channels are several extensive banks of sand which dry at low water, the edges of these banks, where they approach the channels, are marked by buoys.

The Coast from Amherst point gradually slopes to the beach a third of a mile inside the river, and trends to the eastward for 2 miles to the entrance of the Wakharu chaung, a large creek which takes a south-easterly direction for about 20 miles to the foot of the hills in the interior. A low point separates Wakharu creek from another large creek (Tama-o chaung) which takes a more northerly course, and also extends for a considerable distance inland. From its mouth the low shore, fringed with mangroves and willow, trends to the westward for half a mile, and forms a deep bight, filled up by a mud flat extending $6\frac{3}{4}$ cables to the southward, which, except at high water, is dry and forms the north side of the

entrance to the two creeks. From these creeks the shore takes a N. by E. direction, and is low and covered with thick jungle to the water's edge. At 4 miles north of the Wakharu, on the edge of the bank immediately north of a small creek (Wai-gyi chaung), is a white wooden beacon; and $5\frac{1}{2}$ miles north of it, is a similar beacon before mentioned.

AMHERST.—Just inside Amherst point is the small village of Amherst (Kyaik-Khami), containing only a native population. There is a post office at the village, and a telegraph office on the point, in connection with Moulmein, to which there is a good carriage road; the distance is 56 miles.

Amherst sand.—Inside Long Stones reef and parallel to the shore abreast the village, is a narrow bank of sand, which at low water spring tides uncovers; its south edge, steep-to, approaches within 5 cables of one of the groups of Long Stones reef. From the north end of this sand, known as Amherst sand, a shoal ridge, with patches of sand drying at low water, extends to the north-east, parallel to the bank of the river, leaving a narrow channel of deeper water between the ridge and the shore as far as the north white beacon.

Amherst road.—Inside Amherst sand, off the village, is good anchorage in 4 fathoms close to the bank of mud, which dries out 2 cables from the beach; but it is only available for vessels of moderate draught. The ridge of shoal water before mentioned as extending northward from Amherst sand, has only 8 feet over its deepest part at low water, and this ridge must be crossed when standing in for the road. The leading mark for crossing the ridge in the deepest water is Water pagoda (on the rocks below Amherst point) in line with the west extreme of Green island.

ANCHORAGE.—The best anchorage for vessels outside the river is in from 6 to 9 fathoms, with Green island between the bearings S.E. by E. $\frac{1}{2}$ E. and N.E. $\frac{1}{2}$ N., distant one mile. The holding ground is good, but during spring tides the tidal stream at this anchorage runs with great velocity, and it is necessary to give a vessel plenty of cable.

Vessels should not, except from necessity, anchor north of the entrance, as the holding ground is not good, and the combined tides of the Sittang and Moulmein rivers are exceptionally strong, sometimes attaining a velocity of 7 knots an hour.

Inside the river vessels can anchor anywhere in the channel between Ann rock and the lower part of Balugyun channel, in from 24 to 36 feet at low water. Another good anchorage, to wait for the tide, is to the northward of the north white beacon abreast Kyan chaung (known to the pilots as Lower anchoring creek), in 28 feet at low water.

TIDES.—It is high water, full and change, at Amherst at 2 hrs. 15 m.; springs rise 22 feet; and neaps 12 feet. At Lower anchoring creek the tide is about one hour later. Outside the entrance, the flood stream sets to the northward along the coast, the ebb to the southward; and the velocity of the stream, augmented on the ebb by the water from the Sittang and Salween rivers, is very great. Off the entrance to Moulmein river the set of the flood stream is towards Long Stones reef and the navigable channel north of it; thence to the north-east as far as the buoy (black spiral with red ball), which marks the lower part of the Old channel. Here the stream splits and takes various directions through the numerous shallow channels between the banks, the main streams being those which flow directly in the direction of Balugyun and Old channels.

When the outer banks are covered, the flood stream sets strongly to the eastward over the sands. In the month of August the river is much swollen by the rains, the tide rising to 26 and 28 feet, and the stream attaining a velocity of 7 knots an hour. The flood stream ceases almost immediately after it is high water, but the ebb stream runs from one to $1\frac{1}{2}$ hours after it is low water at Amherst. At Lower anchoring creek the ebb stream runs from 2 to $2\frac{1}{2}$ hours after it is low water at Amherst, and the flood for one hour after it is high water at Amherst.

WINDS AND WEATHER.—In December the wind is chiefly from N.E. to East, light, and sometimes veering to North and even N.W.; the weather fine and clear. In January the wind continues light from the same quarter, but in the early part of the month the mornings and evenings are misty, though the weather is fine; towards the end of January the wind veers more to the south-east, and the weather becomes foggy. In February light land and sea breezes set in, the land breeze being from East and N.E., the sea breeze from West and N.W. The weather is fine, but the fogs become frequent and thick towards the end of the month. In March the land and sea breezes continue, the land breeze being from S.E. and the sea breeze from S.W., the former light, but the latter sets in with strength and blows fresh at Amherst between 2 and 4 P.M., after which it dies away. The weather is fine, but thick fogs, which last for three and four days at a time, occur throughout the month.

At this time the navigation of the river becomes difficult, as the fogs obscure even the banks of the river. During this month the natives light large fires to burn the paddy husk and straw, and the dense smoke helps to envelop the country in obscurity. As the land is seldom or never to be seen at a greater distance than half a mile during March, it is imperative that vessels bound for Moulmein should make the

land well to the southward, and sight Double island before steering for the river.*

The rainy season commences about the middle of May and ends about the middle of October, and the weather from July to September is very stormy. The climate is comparatively healthy; March, April, and May are the hot months, the rest of the year being cool. From November to February the thermometer ranges from 83° to 69° in the shade.

Pilots.—During fine weather small pilot schooners cruise between the entrance of the river and Double island. Should none be met with, a vessel should anchor off Green island, in the position before mentioned, and make a signal to the station at Amherst. There are a few European pilots, but the greater number are natives; they are licensed, and there is a fixed scale of charges, which may be obtained on application to the Master Attendant at Moulmein. Pilotage is compulsory for vessels of 200 tons and upwards. The pilot leaves a vessel one mile S.W. of the Patch buoy. Steam tugs ply on the river.

DOUBLE ISLAND is small, steep-to all round, and situated $12\frac{1}{2}$ miles S. $\frac{3}{4}$ E. from Amherst point, about $5\frac{1}{2}$ miles from the coast.

The island is about 100 feet high and well wooded but not easily distinguished from a distance seaward, under the high land. A small portion is cultivated by the keepers of the lighthouse. Its double appearance caused by a cleft in the trees, is most apparent when it bears between N.E. by E. and S.E. Approaching Double island at night a vessel should sound frequently, and not get into less than 12 fathoms before the light is sighted.

LIGHT.—On Double island is a masonry lighthouse 75 feet in height, from which is exhibited at an elevation of 164 feet above high water, a *fixed white* light, visible between the bearings of N. $\frac{3}{4}$ W. round by east to S.S.E., from a distance of 19 miles in clear weather. The former bearing leads $1\frac{1}{4}$ miles westward of Kalegauk island, and the latter $1\frac{1}{2}$ miles westward of the Patch buoy off Amherst. A strip of light shows from the Patch buoy eastward as far as Amherst point.†

Vessels making the light, should endeavour to keep it between the bearings of S.E. and N.E., paying particular attention to the tides, as at springs they run about 5 knots an hour, parallel with the coast. Vessels standing too close to the land will lose sight of the light, but so long as the light is in

* Vessels frequently get on shore in the fogs on Balugyun and Goodwin sands in consequence of keeping too far to the northward; and as the banks are steep-to, the lead gives no warning of an approach to danger.

† In the morning, the lighthouse on summit of Double island is not so conspicuous as two or three high trees standing to the south-east of it. The landing place is at a crane on east side of the island; landing is difficult in bad weather.

sight there will be no danger until 10 miles northward of it, when approaching the Goodwin sands, where the tides set very strong. The anchoring ground in the vicinity of Double island is good, but, on account of the strength of the tides, vessels should avoid as much as possible the risk of anchoring in such deep water.

DIRECTIONS.—Bound to Moulmein from the bay of Bengal, a vessel should, after passing Alguada light, steer to make Krishna light, and not work up on the eastern shore of the gulf of Martaban, as it has been but roughly surveyed, and the lead gives little or no warning of approach to danger. After making Krishna light and bringing it to bear North, distant 4 to 6 miles, in from 10 to 12 fathoms, a course E. by N. $\frac{1}{2}$ N. should be shaped for Double island light (distant from the Krishna 122 miles). Stand in towards Double island to within 2 or 3 miles, and then haul up to the north for Amherst point, distant about 12 miles.

In thick weather during the south-west monsoon, and the position of the ship being doubtful, it will be advisable to keep well to the southward and make the land a little south of Kalegauk island or in lat. $15^{\circ} 30'$ N. In the event of bad weather, more particularly if it be at or near spring tides, a vessel should not anchor at Amherst but run up inside Kalegauk island, and anchor in from 6 to 9 fathoms.

In clear weather, and often on a bright moonlight night, the high mountains in the interior, east of Double island, will be seen before the light is sighted.

As the tide sets with great velocity along the coast, care must be taken at night not to be swept to the northward of the entrance to Moulmein river, as there is no light on Amherst point to guide vessels. By keeping Double island light in sight bearing eastward of S.S.E., the vessel will be kept well clear of danger; but as before mentioned, great care must be taken not to stand too far to the northward, it being better to anchor well to the southward of the river.

Caution.—When standing to the northward, a constant look-out must be kept on the light, as a vessel may, by being set in towards the shore, lose sight of the light, cross the strip of no light, and re-sight it again when close to the rocks.

Anchorage may be had in from 9 to 11 fathoms between Double island and Green island, at about $4\frac{1}{2}$ miles off shore.

From Rangoon to Moulmein.—In shaping a course care must be taken to allow for the state and time of tide during the passage, or the vessel may, especially in foggy weather, be placed in a dangerous position.

At this time great attention should be paid to the lead, and the vessel should not shoal to less than $5\frac{1}{2}$ or 6 fathoms at low water. Having run nearly the distance, should the weather be thick and the land not

discernible, it would be prudent to anchor immediately if there is the slightest indication of deepening the water to over 7 fathoms (low water), as the deepest water (9 to 11 fathoms) is close to the sands. In fine clear weather, the lofty, sharp, conical peak of the Zingyaik mountains, north of Balugyun, will be seen on approaching the river from Rangoon. From 10 to 15 miles in the interior, south and east of Amherst, are lofty hill ranges and peaks, which in clear weather are seen 30 to 45 miles distant.*

MOULMEIN† is 30 miles from the entrance at Amherst by the course of the river; it is built on the left bank of the river, is clean, and has some fairly substantial buildings. On a low ridge behind the town are several pagodas. The Master Attendant's, Custom, and Post offices are on the banks of the river. There is a good iron landing pier opposite the former, and the river bank is bunded for some distance. The town contained in 1876, a population of about 56,000, of which 1,100 were Europeans.

A small detachment of troops is stationed here. The chief exports are timber (teak) and rice. Though the town is improving, the timber trade is falling off and the prices are high; in 1876 the timber exported amounted to 105,154 tons, and the quantity of rice to 178,885 tons. Vessels moor with two anchors off the town in about 6 fathoms at low water; there are no moorings laid down. Repairs to vessels and engines, if not heavy, can be executed, and there is a dry dock and gridiron, as also a wet dock available for vessels of 12 feet draught, except in the north-east monsoon. In 1876, 618 vessels left the river, the greatest draught being 23 feet. The salt water worm (*teredo navalis*) is very destructive in Moulmein river.

Dimensions of Dry Dock.

Length over all.	Breadth of Entrance.	Depth on Sill at highest Spring Tides.
250 feet.	42 feet.	13 feet.

* In the gulf of Martaban, the south-west monsoon may, after May 20th, be said to have fairly set in, although it is occasionally later. From this date to August 20th, a great deal of bad weather is experienced. Vessels leaving between the dates mentioned should be prepared for a trying passage, especially from Moulmein. The weather should be considered previous to leaving, because with a prevalence of bad weather about the full and change of the moon, it is possible a few days of moderately good weather will follow, of which advantage should be taken.—Captain N. Heckford's Sailing Directions for Bay of Bengal, 7th edition, pp. 82, 83.

† Vessels should not remain at single anchor off Moulmein but always moor.

There is weekly mail service to Rangoon and Calcutta, and fortnightly to Akyab, Chittagong, Penang, Singapore, and intermediate ports, by vessels of the R.I.S.N. Company.

Tides.—It is high water, full and change, at Moulmein at 4h. 30m. Springs rise 14 to 15 feet, neaps rise 11 to 12 feet. Extraordinary springs sometimes rise 17 feet.

Supplies.—Beef, pork, poultry, and fish can be obtained at moderate prices. The meat is of inferior quality, and vegetables are scarce. Vessels supply themselves with water from the river, which is perfectly fresh at certain times of tide.

Coal can be obtained at Moulmein.

The Coast outside the river, from Pagoda point abreast Green island of Amherst, trends to the south-east for about 19 miles, then curves to the south-west for 4 miles to Bluff point, forming a bay the water in which appears shallow. Eastward of Double island in this bay, an extensive flat is said to exist, and the south-east part of the bay is bordered by a low shore which should not be approached. Under ordinary circumstances of navigation no vessel should pass inside of Double island. The land southward of Amherst is mostly high and may be seen 30 miles off.

North Rocks, of which there are two detached groups bearing north-east and south-west of each other, $1\frac{1}{2}$ miles apart, are about 20 feet high, but should not be approached on the western side, nearer than a distance of $2\frac{1}{2}$ miles, or outside the limit of visibility of the light on Double island. North rocks lie to the south-east of Double island, distant about 6 miles, and are about $2\frac{1}{4}$ miles distant north-west of Bluff point.

KALEGAUK ISLAND, the north point of which bears S. by E. $\frac{1}{4}$ E., distant 17 miles from the lighthouse on Double island, affords an important land fall, during the south-west monsoon for vessels bound to Moulmein; at which time, Bentinck sound, between Kalegaul and the main, offers safe anchorage for vessels of any size. The island is $5\frac{1}{4}$ miles in length, north and south, or parallel with the shore, by $1\frac{1}{4}$ miles in extreme width, and is formed of several hummocks, the northern of which, mount Woodstock, (about 200 feet,) is the highest. Forests of fine trees clothe the entire island. A quarter of a mile south of the south point is Cavendish islet, from which, reef extends in a southerly direction for about a quarter of a mile. The west side of Kalegaul island is said to be lined with reef and should not be approached nearer than in 10 or 11 fathoms.*

* The stone used for building the Alguada reef lighthouse, was procured at Kalegaul island, the northern half of which on the western side is composed of a long granite ridge. Commander Taylor remarks "the highest part of Kalegaul island about one mile from the north end is perhaps 400 feet high, with some remarkable trees. When viewed from a distance of more than 10 miles the land appears like three islands off the south end of Kalegaul."

Galloper Sand, between which, and the north end of Kalegauk island, is a narrow channel 5 fathoms deep, through which the tide sweeps at the rate of 5 knots, is a shoal, extending in a N. by E. direction, for a distance of nearly 6 miles. The sand dries at low water over a considerable part of Galloper sand. Abreast the northern end of Galloper sand is Pulo Kropik or Tree island, about a mile from the main land, and between the island and north end of Galloper sand is the north channel into Bentinck sound, 10 fathoms deep and about three-quarters of a mile wide. At about 3 miles from its south end, Galloper sand appears almost divided by a narrow channel, into two parts.

BENTINCK SOUND,* between Kalegauk island and Galloper sand on the west side, and the mainland on the east, affords secure anchorage especially during the south-west monsoon, in from 6 to 8 fathoms over a space $3\frac{1}{2}$ miles in width by nearly 10 miles in length. The best position is in 6 to 7 fathoms, about half a mile north-east of Steep point, which point is about the centre of the east part of the island.

In entering from the southward pass at a distance of about a mile from Cavendish islet and haul to the northward, maintaining a distance of about a mile from the east coast of Kalegauk island, anchoring about a mile north-east of steep point.

A stream of fresh water flows through the centre of Kalegauk island, and at Mahomet's well, even during the dry season, 3 or 4 tons of excellent water per day, could in the year 1830 be procured. Supplies of buffaloes and rice were obtained in H.M.S. *Satellite* at a village up Dermonjai creek on the mainland, on the south-east side of the sound. Wood and fruit were also procurable.

Tides.—It is high water, full and change, in Bentinck sound at 12h. 50m. Springs rise 19 to 22 feet. The stream of the tide near the anchorage off Steep point, runs $3\frac{1}{2}$ knots. In the offing outside Kalegauk island, at a distance of about 7 miles from the land, the flood stream at spring tides, was found by Captain Ross, I.N., to run from 3 to 4 knots, increasing in strength as Amherst was approached.

THE COAST from Dermonjai creek, on the south-east side of Bentinck sound, trends to the southward for 21 miles, and increases in height to an altitude of 1,500 feet at Pagoda point, the north point of entrance of the river Ye. This ridge of high land is visible at a distance of 30 miles. Several small islets or reefs lie near the shore on this part of the coast, rendering it prudent to give it a berth of 4 or 5 miles, and advisable not to shoal the water below 11 fathoms. The stream of the flood at springs, sets 3 knots to the northward, along this part of the coast.

* See Admiralty plan of Bentinck sound, No. 835; scale, $m = 0\cdot98$ inches.

YE RIVER, the entrance of which, about half a mile wide, is in lat. $15^{\circ} 12' N.$, is fronted by a group of islands and reefs and has not been surveyed. The town of Ye, capital of the province of the same name, is about 5 or 6 miles above the river's mouth. The river enters the sea between Pagoda point on the north and Bluff point on the south; both points are bold, Bluff point being about 300 feet high, but the entrance is exposed and obstructed, and considered unsafe for vessels of much tonnage. Timber, obtained from the mountainous district through which the river flows, is exported from Ye.

Aye island, near the shore, abreast of the north part of the ridge of high land previously alluded to, is in about lat. $15^{\circ} 19' N.$, and $7\frac{1}{2}$ miles northward of the mouth of the river Ye.

Stag island, about $1\frac{1}{2}$ miles in length, north and south, is situated about 2 miles north-west of the river Ye entrance, and is 250 feet high.

Bath Bun island, lying westward of the river Ye mouth, is about a mile in extent, and 300 feet high.

Breakers and a danger line are marked on this part of the coast about $1\frac{1}{2}$ miles outside or westward of Stag and Bath Bun islands. As this part has not been surveyed, navigation near it should be conducted with caution.

THE COAST from the entrance of Ye river trends south for 19 miles to White point, and is almost unknown. A ridge of high land approaches the sea at White point, having on it, North and South peaks, $1\frac{1}{2}$ miles apart, forming a saddle, about 7 miles to the northward of the point and 5 miles inland. North peak is in about lat. $14^{\circ} 59' N.$, long. $97^{\circ} 52' E.$

Pig Islands, of which there are two, form a continuation to the southward, of the chain running parallel to the coast off the mouth of the river Ye. The southern, the larger of the two Pig islands, in lat. $15^{\circ} 5' N.$, extending nearly 2 miles N.N.E. and S.S.W., is about 300 feet in height, and $2\frac{1}{4}$ miles off shore.

Tamarind island, about 5 miles S.S.E. of the southern Pig island, is small, and surrounded by reef.

Ross Sand, $6\frac{1}{2}$ miles from the coast, and believed to be the outside danger off White point, appears to consist of two patches of 3 fathoms, with about 4 fathoms over the connecting neck; the whole extending for a distance of $5\frac{1}{2}$ miles in a north and south direction, or parallel to the coast, between lat. $14^{\circ} 53'$ and $14^{\circ} 58' 30'' N.$

Caution.—It is recommended to give Ross sand a berth of at least 7 miles, especially during the south-west monsoon, the chart of this part of the coast being almost without soundings.

THE COAST* from White point trends S.S.E. for about 48 miles, or to lat. $14^{\circ} 8' N.$, in about which position and facing the sea is a

* See Admiralty chart, White point to Mergui, No. 824; scale, $m = 0.2$ inches.

lungalow, the residence of European officials connected with the jurisdiction of the Tavoy district, the town of which name lies about 9 miles south-east of it. This part of the coast is said to be fronted by rocks and by a sandbank with 4 fathoms over it, which stretches out to a distance of 5 miles from the shore in about lat. $14^{\circ} 36' N.$ * A high mountain, visible 50 miles, is situated about 3 miles inland from the coast in lat. $14^{\circ} 23' N.$, or about 33 miles to the southward of White point.

Heinzé Basin, which has not been surveyed, appears to be a considerable backwater, about 10 miles in length by 4 miles in width, with small rivers draining into its north and south parts, the whole being completely land-locked. There are villages on its shores approachable by boats. The entrance, in about lat. $14^{\circ} 42' N.$, is narrow and fronted by rocks above water, the south point resembling a dolphin's nose.

MOSKOS ISLANDS, consisting of three groups, Northern, Middle, and Southern, which are known to the Burmese as Heinzé, Maungmagan, and Laung-lun, extend in a chain parallel to the coast, distant from it from 8 to 14 miles, between the parallels of $14^{\circ} 28' N.$ and $13^{\circ} 47' N.$ Between the islands and the coast is a channel carrying soundings of 10 and 17 fathoms, except in the northern part, or abreast the Northern Moskos, where a middle ground of sunken reef, known as the North ledge, and smaller detached reefs to the south-west of it, apparently obstruct and render hazardous, the navigation of this part of the channel.

The coast bank of soundings appears to extend a great distance westward of the Moskos, there being depths of 50 fathoms at a distance of 65 miles in that direction.

Northern Moskos almost united to the Middle Moskos by scattered islands and rocks, are composed of straggling islands of various sizes, with several rocks above water. From the northern island the high mountain already alluded to near the coast in lat. $14^{\circ} 23' N.$, bears E. by S., distant 16 miles. Reefs are situated at distances of $1\frac{1}{2}$ and 2 miles, from the north island of Northern Moskos, bearing respectively E. by S. and N. $\frac{1}{2}$ E. Near the latter is a rock above water, termed North rock.

North ledge, about 7 miles from the mainland and $4\frac{1}{2}$ miles N.E. by N. of North island, has numerous rocky heads and appears to cover a space of about 2 square miles.

Middle and Southern Moskos contain the largest and highest islands in the group, for the description of which the chart is the only guide. The channel between these groups, about 12 miles wide, is believed to be free from danger, and the islands appear steep-to on their western side.

* Taylor's East Indian Sailing Directory, part 1, page 505.

THE COAST from the Government bungalow, in about lat. $14^{\circ} 8' N.$, trends South and S. by E. for about 37 miles to Tavoy point on the west side of entrance to Tavoy river. The sea face of this part of the coast appears bold and rocky, but its northern part is skirted by sunken reefs to the distance of about a mile. A hilly ridge extends along this part at a short distance from the coast, having in about lat. $13^{\circ} 55' N.$ a hill with a pagoda, and in about lat. $13^{\circ} 50' N.$ a bluff headland or point, with rocks awash off it. There are also two small islands without names, for the position of which the chart should be referred to. The Tavoy river runs up in a northerly direction or parallel to this part of the coast from which it is distant about 9 miles, and for the description of which see next Chapter.

Cap islet, about 3 miles westward of Tavoy point and three-quarters of a mile from the shore, is small, round, and bushy, and affords a good mark for vessels approaching from the north-west. It should be passed on its southern side.

TAVOY POINT, in lat. $13^{\circ} 32' N.$ is a moderately high bluff, covered with trees, and has a pagoda near its extremity, conspicuous when seen from the westward. Immediately within Tavoy point there is good anchorage for a large vessel in 6 fathoms, soft even bottom, with the point bearing S.W. by S., distant about one mile. (See page 315.)

CHAPTER IX.

COASTS OF TENASSERIM AND SIAM WITH MERGUI ARCHIPELAGO. — TAVOY RIVER TO JUNKSEYLON AND BROTHERS ISLANDS.

VARIATION $2^{\circ} 50'$ E. IN 1887.

TAVOY RIVER* has its main sources near the north boundary of Tavoy district, in the western slopes of the range forming the boundary between Burma and Siam, and is about 120 miles in length, and navigable for short vessels of 8 feet draught as far as Tavoy, 30 miles from the mouth; vessels of 12 feet can ascend for 19 miles. From Nyaung-daung-lai to Rwon-lai, which is about 32 miles northward of Tavoy, it is navigable for small boats only, below this the rapids cease, and tides are felt. Three miles above Tavoy the river enters a broad plain, its course impeded by sand banks and alluvial islands, constantly changing in form and position. These obstruct the course of the river until the estuary is reached, into the north-east corner of which, three small rivers fall, the mouths of which are blocked by sand and mud flats. Many tidal creeks intersect the plain between the banks and the base of the hills on either side of the river.

The hills run in parallel ranges generally north and south. At Tavoy point (Shin-maw) they rise directly from the shore line to a height of 1,120 feet, gradually receding from the river along the right bank, and at Goodridge plains are $1\frac{1}{2}$ miles off, and nearly 2,000 feet high. They gradually close the bank abreast of Tavoy.

On the left bank of the estuary are low coast hills, with parallel ridges behind them gradually increasing in height to Nyataung range, 4,000 feet above the sea. Buktaung, 2,195 feet, is abrupt and conspicuous, rising from a small range near the coast; and to the northward Thejaungtaung, similar in appearance, is also conspicuous, and makes a good mark to steer for after rounding Shin-maw and before shaping course up the river. Northward of Elbow point (Thamókmo), the hills close the left bank, and at Tsinbyubyin are $1\frac{1}{4}$ miles off, maintaining about that distance to Tavoy, where they recede. They increase in altitude in successive ranges until the final Nwa-la-bo range with its conspicuous peak, 5,000 feet high, bounds the view.

* See Admiralty Charts:—Bengal, east coast, sheet 4, White point to Mergui, No. 824; Tavoy river, No. 924; scale, $m = 1$ inch.

The town of Tavoy, the head-quarters of the Tavoy district, has a court house, treasury, jail, and hospital, and is connected by telegraph with Moulmein and Bangkok. The main wharf is about 36 miles from Tavoy point. The town lies low, and its north-west and south portions are flooded at high spring tides. It is methodically laid out in straight streets. Population in 1878 about 14,800. Rainfall is heavy, averaging from 190 to 220 inches in a year.

Trade.—Exports are rice, dhaní leaves, jaggery, sugar, earthen pots, wood-oil, timber, and fruits; imports, piece goods, long cloth, turkey red cloth, velvets, iron, crockery, tobacco and dried vegetables. Trade is carried on with the Straits Settlements and Penang during the fine season by native craft, which shelter at Tavoy during the monsoon.

Supplies of various descriptions can be obtained.

Communication by steam vessel takes place weekly with Moulmein and Mergui. Steamers trading with the Straits Settlements call frequently at Tsinbyubyin, where there is a rest house and good road leading to Tavoy.

Hnet-thaik-taung or Cap islet is 523 feet high, and steep-to, except on its eastern side, from whence a shoal spit of $3\frac{1}{2}$ fathoms extends for about 3 cables. The channel between Cap island and the main is clear, has 10 to 12 fathoms, and may be used by steam vessels.

Kiantaung, 1,300 feet high near Tavoy point, is covered with forest, but shows a slight clearing when viewed from the east and westward.

Tavoy point or Shin-maw, marked by three pagodas, is steep-to, and may be approached without fear. There is good shelter for vessels northward of the small peninsula.

Proserpine rock or Puklaji, 7 cables to the northward of the N.E. extreme of Shin-maw, is a dangerous patch, one of the rocky heads of which shows at low-water springs. If a vessel requires to anchor under Shin-maw there is sufficient room without nearing Puklaji, and if wishing to pass to the northward of it, where there is good anchorage ground, Button island should be brought on with the left extreme of Reef island N. $\frac{1}{4}$ W., and steered for until Kiantaung or the centre of the sandy beach under it bears W. by N., or till Fisherman islet bears N.W. $\frac{1}{2}$ W., then haul to the westward, and anchor as convenient. Shoal water extends for half a mile off the south-west point of Reef island.

Gogaligyun or Reef island is 470 feet high, about a mile in length and a quarter of a mile in breadth. Clearings of the trees, made for the free passage of the light rays, are conspicuous. Shoals extend to the southward of Reef island for $1\frac{1}{2}$ miles, and it should not be approached from that direction.

Anchorage in 6 fathoms, mud, will be found on the eastern side of Reef island, under the lighthouse, with Whale rocks in line with the left extreme of Tavoy point S.S.W. $\frac{1}{2}$ W. Boats can land on the beach abreast Whale rocks, and a good road extends thence to the lighthouse.

LIGHT.—From a concrete tower, 25 feet high, on a hill near the north-east point of Reef island, is shown, at an elevation of 309 feet above high-water, a *fixed white* light, dioptric, of the 5th order, visible in clear weather from the navigable approaches of the river, or from a bearing of N. 6° E. round through west to S. by E. $\frac{1}{4}$ E., from a distance of 12 miles.

Water is obtainable from a well near the landing place on Reef island, but of inferior quality to that which escapes from under the gravel near high water mark, of which there appears to be a copious supply.

Whale rocks consist of a heap of boulders lying 2 cables off the eastern side of Reef island, bearing S.S.E. distant 4 cables from the lighthouse. Whale rocks, which are just covered at high water spring tides should not be approached within a cable; they afford a good indication of the state of the tide to a passing vessel.

THOMBON-GYUN or Middle island is $2\frac{1}{3}$ miles long, north and south, by from a mile to a quarter of a mile broad, 725 feet high and thickly wooded. It is inhabited during the fishing season from January till April only. Anchorage may be found on the eastern side, half a mile from the shore, northward of Button island.

Satlugyun or Button island consists of granite boulders with trees on them, the whole 162 feet in height, it is useful as a mark for clearing the rocks in the western channel.

KATHEMAWGYN or Grindstone island, situated northward of Middle island, is 550 feet high, three-quarters of a mile in length north and south, by about half a mile in width, and densely wooded. At its north-east point, is a large granite boulder with a pagoda on it, having deep water close-to; the tide runs strongly past it. The small bay to the northward, between the island and the shore, is shallow. Ships drawing as much as 30 feet can proceed as far as this with safety, and good anchorage in 6 fathoms may be found along the eastern side of the islands, already described, in most parts at a distance of about half a mile from the shore.

Yabaichauk or Mahratta Rock, on which the steam vessel of that name struck in 1875, is a dangerous pinnacle, with 7 feet over it at low water springs, and 22 feet close around, marked by a strong ripple. From it, the east extreme of Grindstone island, with the east extreme of Reef island just outside it, bears S. by E. $\frac{1}{4}$ E., distant $2\frac{1}{4}$ miles, and the east extreme of the point next south of Round hill, S.W. $\frac{3}{4}$ S., distant 4 cables,

A bed of laterite with 18 feet over it was found 4 cables to the eastward of Mahratta rock, and the bottom in the locality being generally irregular and hard, vessels should keep to the leading line of the east end of Grindstone island on with the west end of Button island, until they are clear of Chaukdaw rock.

Chaukdaw rock, situated 2 cables from the shore, and $3\frac{1}{2}$ miles from Round hill on a N. $\frac{3}{4}$ W. bearing, has 12 feet over it at low water springs. A vessel steering up the river will be clear of Chaukdaw rock when the conspicuous fall on the southern side of Tawantaung hill bears southward of W.S.W.

Pinjigyun or Crab island, low, and thickly covered with trees, is about 30 feet high, occupies the centre of the river for $6\frac{1}{4}$ miles in a north and south direction, and has an average breadth of three-quarters of a mile. From the southern end, a spit of sand and mud, dry in places, extends southward for three-quarters of a mile, dividing the river into two separate channels. In 1885, a large fish trap in 10 feet at low water, marked the south end of the spit.

Shityangyun or New island, formed during the last 30 years, and joined to Crab island at low water springs, appears to be rapidly extending to the northward. A succession of similar low alluvial islands connected by shoals, stretch up the river as far as Tavoy. Vessels of 12 feet draught cannot advance beyond New island.

DIRECTIONS.*—Entering the river, after rounding Tavoy point which is steep-to, steer N.E., or with the extremity of that point seen astern bearing S.W. $\frac{1}{2}$ W., until the east extreme of Grindstone island is seen just outside the east extreme of Reef island bearing N. by W. $\frac{1}{2}$ W. Whale rocks will then be shut in with Reef island, and a vessel will be clear of the shoal ground stretching southward of Reef island. Now steer a course of N. by W. in the deepest water, to pass 2 cables clear of Whale rocks and Reef island, which course should be altered to N. by W. $\frac{3}{4}$ W., when Button island bears West. This will lead a cable clear of the north east point of Grindstone island, and up to the clearing mark (east extreme Grindstone island on with west end of Button island, S. $\frac{3}{4}$ E. easterly) about 6 cables northward of the north-east point of Grindstone island. Steer upon the leading line until the southern slope of Tawantaung bears W.S.W., when haul over to the western bank of the river and continue along it at a

* Sailing ships leaving Tavoy or Mergui during the south-west monsoon may find difficulty in obtaining an offing; a favourable opportunity should be embraced in sailing from either place. In bad weather, it will be prudent to work to windward with the anchorage under Tavoy point, or that under Tavoy island, open until sufficient offing is obtained to weather the islands of the Mergui archipelago if bound south or of reaching, the coast of Pegu westward of Rangoon river if bound north. (Horsburgh, 8th edition, see also footnote, page 326.)

distance of $1\frac{1}{2}$ cables, until just beyond the port tide gauge, where there is an open space, with tank and rest house. Anchorage may be found here in 13 feet, mud, at low water springs.

A vessel not drawing more than 8 feet, and short and handy, should take a pilot at this anchorage, if intending to proceed to Tavoy.

Bound for Tsinbyubyin and of 13 feet draught, the state of the tide must be considered for crossing the bar at Elbow point; if detained on this account, a vessel will find good anchorage on the eastern side of Reef island. After leaving Tavoy point, having gained a position with the east extreme of Grindstone island seen just outside the east extreme of Reef island bearing N. by W. $\frac{1}{2}$ W., and Tavoy point bearing S.W., a vessel should steer N. $\frac{1}{4}$ E. or for the left extreme of Elbow point, until the right extreme of Middle island bears W. $\frac{3}{4}$ S., when a large fish trap (1835) at the end of the central spit should be in line with it; then steer N. by W. $\frac{3}{4}$ W. or for the left extreme of Crab island, and so continue until the projecting mangrove point next south of Elbow point, bears E. by N. $\frac{3}{4}$ N., when Button island should be just opening to the left of Middle island. Then steer N. by E. $\frac{1}{2}$ E. so as to pass Elbow point at a distance of about 3 cables, and gradually closing to one cable, continue at this distance until the left extreme of New island bears W. by S.; this will be in the anchorage, which extends about 3 cables north of the bungalow, and is a cable broad, for vessels of 12 feet draught. The bottom is soft, and the tide runs about 3 knots at half flood.

TIDES.—It is high water, full and change, at Reef island at 10h. 57m., springs rise $15\frac{1}{2}$ feet, neaps rise $10\frac{1}{2}$ feet, neaps range $5\frac{1}{2}$ feet; at Tsinbyubyin 11h. 16m., springs rise $16\frac{1}{4}$ feet, neaps rise 11 feet, neaps range $6\frac{1}{4}$ feet; at Tavoy 12h. 0m., springs rise 12 feet (approximate).

Above Tsinbyubyin local knowledge is indispensable, as shoals are numerous and the channels continually altering. A launch can steam from Tsinbyubyin to Tavoy in 2 hours, leaving at half flood, near the springs. In the height of the rains, during neaps, there is no flood stream felt above New island.

Inzaukaiyu rock, which dries 2 feet, is situated close to the right bank, at a place called Biyaungbauk, opposite to Shwegyun, off which runs a sandy shoal. To clear this shoal and mark the rock, two buoys are placed.

Off Tavoy there is no room for anything larger than a cargo boat to swing. The fortnightly steamer arrives at high water, turns, and moors to a pontoon which is secured to the bank.

MERGUI ARCHIPELAGO.*

GENERAL REMARKS.—The islands of the Mergui archipelago extend from Tavoy island, in lat. $13^{\circ} 13' N.$, to Sayer islands in lat. $8^{\circ} 30' N.$, and in some instances lie 70 miles off the mainland. These islands, being high, may be seen from 25 to 40 miles distant. Their west sides generally present lofty perpendicular cliffs to seaward, but on the east, they slope gradually and have several sandy bays. The northern islands have extensive mangrove bushes. The most westerly are composed of granite and porphyry, those nearer the shore of sandstone and conglomerate. They are covered with large trees and thick underwood, yielding excellent timber, the caoutchouc tree being said to grow in great abundance. Tin is known to exist on some islands and coal is suspected. Maingy island has abundance of lead ore. A few wandering fishermen (Selungs), who live in their boats, are the only residents of the archipelago. These are an inoffensive uncivilised race, subsisting chiefly on fish, and following agriculture in a rude manner. For rice and clothing they barter sea slugs and forest produce. Malays and a few Chinese visit certain of the islands annually to collect edible birds' nests, found in almost every rocky island. Trepan or Beche-de-Mer (sea slug) is an object of search, but it is scarce, there being no extensive coral shoals.

On the beaches of several islands the marks of deer and hog were seen, also a footprint, said to be the tiger's, but none of these animals were met by the surveyors. The islands rest on a rocky basis, and on many of the rocks, wholesome oysters abound. There are many small barren rocks amongst the islands of the archipelago, usually with deep water near them.

Between Tavoy point and Pakchan river, a distance of nearly 250 miles, there is almost completely sheltered navigation amongst the Mergui islands for steam-vessels and small sailing craft. The beaten track (which will be described) was frequented by Chinese junks before Burma became a British possession. For several years steam vessels have navigated these passages.

ROUTES.—The best route for steam vessels from the southward, is eastward of St. Matthew and Hastings islands, thence through Forrest strait to the northward, passing to the westward of Bushby, and Domel islands. Small vessels pass eastward of Owen, and Domel, islands; but when abreast the middle of Domel island, the passage nearly dries across at low water springs, leaving a narrow creek through sandbanks on the west side near the Domel shore, termed Celerity passage.

* See Admiralty charts :—Mergui archipelago, Nos. 216a, and 216b.

WINDS AND WEATHER.*—The north-east monsoon commences in the Mergui archipelago about the middle of October, at which time the wind is at East, occasionally blowing fresh. In December, at about noon, the sea-breeze sets in from N.W., veering to North at sunset, and by midnight the wind is from E.N.E. or East, at times blowing strong between sunset and 11 a.m. on the following day. By keeping near the islands a sailing vessel will get rapidly to the northward; whereas in the offing, the wind will be found chiefly from N.N.E. to N.N.W. In March, the sea-breezes amongst the islands set in from the southward of West, with light winds and calms in the offing. In February and March, light winds have been experienced between Kabosa and cape Negrais, with a weak current setting to the southward. In April the afternoon becomes squally with the wind at East, and much thunder and lightning may be expected amongst the islands.

The south-west or rainy monsoon sets in about the middle of May, after which, the archipelago is subject to squally weather for successive days, and a deluge of rain; the rain lasts till September. The surveying vessel *Nearchus* was amongst the islands during the whole of the south-west monsoon; it appears that a vessel may easily work to the southward within the islands, as she frequently experienced several successive days of fine weather.

SOUNDINGS.—The bank of soundings extends for some distance outside most of the islands, but has not yet been thoroughly examined; near some the water is deep, yet their proximity may easily be known by the lead, if kept going. In passing through any of the channels, or inside the islands, a continuous good look-out is necessary, as unknown dangers have been found to exist.

The channels between the outer islands, are so imperfectly known that it is advisable to warn navigators against adopting any of the central entrance channels from seaward, except *Nearchus* passage in lat. $11^{\circ} 50' N.$, Forrest passage in lat. $11^{\circ} 5' N.$, and Investigator channel in lat. $10^{\circ} 15' N.$ If to the northward of these, it is better only to approach the mainland through Tavoy channel, which lies between $13^{\circ} 20'$ and $13^{\circ} 30' N.$, or, if to the southward, by passing south of Chance island in lat. $9^{\circ} 20' N.$

* The winds about these islands and the Tenasserim province are sometimes affected by the weather in the gulf of Siam. The neck of the Malay peninsula in the vicinity of Pakchan is less than 50 miles broad, and the mountain ranges eastward of Pakchan river are of less elevation than those to the northward, or to the southward, towards Kopah. Eastward and southward of the latter place, the mountains of the Malay peninsula are very lofty, and consequently the monsoons at Junkseylon island are more regular.—(Commander A.D. Taylor, late I.N.)

TAVOY ISLAND, the north point of which is about 19 miles southward of the pagoda on Tavoy point, is about 17 miles in length north and south, by 2 miles in breadth, and the highest part in about lat. $13^{\circ} 5' N.$, is about 2,000 feet high. On the south-east side is a pagoda, near to which, good fresh water can be obtained. Though considered fertile, it has only some houses and a few settled families of Selungs. The caves in the hills of the island are tenanted by the edible-nest-building swallow, and the right of taking the nests, which are exported to China, is leased by the Indian Government. The western side of the island is very steep, and a string of islets and rocks, extends in a S. by E. direction for about $6\frac{1}{2}$ miles from its southern point.

Port Owen,* on the north east side of Tavoy island, affords good anchorage, protected from the eastward by Edward, William, Rich, and Campbell islands, which are joined together by a shallow flat which dries at low water. A mud bank of 12 to 20 feet extends south-eastward from these islands, and nearly meeting Fisher peninsula which projects from the east side of Tavoy island, assists to shelter the anchorage. The depth in the harbour is from 7 to 12 fathoms, and in the narrow channel formed by the mud bank and the peninsula, $4\frac{1}{2}$ to 6 fathoms.

Tides.—It is high water, full and change, at 10h 50m. Springs rise 20 feet. The stream of flood sets fairly to the southward in the direction of the trend of the harbour, at springs, 3 knots. Wood and fresh water are easily obtained.

Tavoy island and the islands just mentioned, are 14 to 16 miles from the mainland. The channel between is navigable, and affords anchorage; eastward of port Owen its width is contracted to less than 5 miles by a bank of 10 to 15 feet, which extends about $6\frac{1}{2}$ miles from the shore of the mainland, and its depth in this part, through which the tide sets with a velocity of $1\frac{1}{2}$ knots at springs, is from 5 to 8 fathoms. The Tavoy islands being high can be made at night. The lead gives warning of too near an approach to the bank off the mainland, towards which a vessel would only be set on a strong flood tide.

GREAT CANISTER, a high conical island about 5 miles westward of the southern part of Tavoy island, is about $2\frac{1}{2}$ miles in length north and south, by a mile across in its central part, which is also the highest. It has an irregular outline, and the depths near it are unknown. About 3 miles north-east of Great Canister, and between it and Tavoy island, are three high black rocks or islets; also, at about 4 miles south-east of Great Canister is another group of high rocks, the vicinity of which should be avoided.

* See Admiralty plan of Port Owen No. 835, scale, $m =$ one inch.

Little Canister, situated $6\frac{1}{2}$ miles S. by E. $\frac{1}{4}$ E. of Great Canister, is a high conical islet covered with trees, and apparently bold and rocky. No soundings have been obtained nearer to it than a distance of $1\frac{1}{2}$ miles.

KABOSA, the northernmost of the outer Mergui islands, is of moderate height and covered with jungle. The approximate position of its centre is lat. $12^{\circ} 47' N.$, long. $97^{\circ} 53' E.$ Close to its north side is a small islet.

West Canister is a small, steep, high island, covered with jungle, about $8\frac{1}{2}$ miles south-west of Kabosa, the channel between being termed Investigator passage; it resembles Little Canister island in appearance, but its northern end slopes more gradually and is of a snout-like aspect. About $4\frac{1}{2}$ miles eastward of West Canister, is a group of pinnacle rocks above water.

Freak islet, about 5 miles southward of Kabosa island, and midway between it and Tenasserim island, is low, with a few scraggy trees on it, and surrounded by rocks.

A sunken reef has been reported to lie $14\frac{1}{2}$ miles E. $\frac{1}{2}$ N. from Freak island, but its existence is considered doubtful, the chart showing near this position a depth of about 25 fathoms.

Tenasserim island, about 10 miles southward of Kabosa island, almost circular in shape, is one of the largest of the outer islands of the group. It is 3 miles across, and its lofty peaks (near the centre of the island) appear, when viewed from a distance, like two or three islands. Off its north end are Herbert and Howard islands, the latter distant from it about $1\frac{1}{2}$ miles. Off the east and south-west sides of Tenasserim island, distant about a mile, are detached islets of which little is known.

Brown rock, about 8 miles S.S.W. of Little Canister, is well above water, with rocks which occasionally uncover to the north and south of it; it is therefore advisable not to approach it nearer than a distance of 2 miles.

Iron island is about 5 miles in length N. by W. and S. by E., and $1\frac{1}{4}$ miles across, the summit 1,203 feet high, being near the south end. Off its north point are rocks which uncover at low water.

DIRECTIONS.—A vessel having made Kabosa island may pass north or south of it, and thence steer either for the channel north of Iron island or for that between Iron and King islands. In the channel north of Iron island there are strong eddies especially during the south-west monsoon.* A strong current also prevails at the same period in the channel south of Iron island.

* In channel north of Iron island found strong eddies and tide rips, the water foaming and whirling so as to slue the ship four points on each side of her course. Did not find the eddies between Iron and King islands anything like so strong.—(Navigating-Lieut. E. O. Hallett, H.M.S. *Cossack*, April 1871.)

Tides.—It is high water, full and change, at Kabosa island at about 8h. The set of the tide is irregular; in the channels on either side of Iron island, the flood stream appears to set to the eastward.

Maingy island is situated off the west side of King island, from which it is separated by a narrow channel believed to be unnavigable. It is about 1,800 feet high and visible 35 miles. The summits of Maingy and King islands are in line on an E. $\frac{1}{2}$ S. bearing. Maingy island is said to have an abundance of lead ore.

KING ISLAND, north-westward of Mergui, is 23 miles long north and south, by about 7 miles in breadth. It has a scanty population of Karengs and Burmese, and is rich in alluvial land and fine forest trees. Plantain island or peninsula on its north-east side, forms with its northern point, an anchorage known as King island harbour or sound, where very good water can be obtained.

Deep water runs up in a narrow bight, close to the north-west entrance bluff and the stream will be found half a mile from the bluff, where there is a stony beach and a small rocky islet. Boats should go for water at half flood.

Lys shoal, a rocky patch, having over it 11 feet at low water, lies $1\frac{1}{2}$ miles N.E. by N. of the north-east extreme of King island. To avoid this shoal on entering the sound, do not let the small western islet (Tavoy islet), bear south of S.S.W. until within the headlands. Little Canister entirely shut in behind Iron island clears it to the northward.

Anchorage.—At spring tides a vessel should anchor with the right extreme of the entrance bluff bearing N. by W. distant half a mile, but at neap tides 16 or 17 feet will be got at low water on the middle bank off the watering place.

A mangrove creek through which canoes can pass, connects the head of King island sound with Fell passage.

Directions.—Stand in with the small western islet (Tavoy islet) bearing S.S.W. until soundings are obtained in 9 fathoms, when haul to the westward and anchor as above.

Tides.—It is high water, full and change, at King island sound at 10h. 45m., and the rise of tide is from 12 to 16 feet.

MERGUI HARBOUR* is formed between the west coast of an island of the same name at the mouth of the Tenasserim river, and Madramakan island, generally known as Patav, which latter gives its name to a conspicuous hill at its northern end, 785 feet high. Madramakan island

* See Admiralty plan :—Mergui harbour, No. 218; scale, $m = 4$ inches; also, plan on Admiralty chart, bay of Bengal, No. 70.

is 2 miles long north and south, by about three quarters of a mile in breadth. At its southern end is a hill called Patitaung 264 feet high.

The town of Mergui (population in 1886, 8,870) is the most important in the southern province of Burma, and the head-quarters of a Deputy Commissioner. A considerable number of Chinese emigrants are here settled, and trade is carried on with Rangoon, Tavoy, Singapore, and Penang, by both steam and sailing vessels; the British India Steam Navigation Company calling monthly. The mails arrive once a fortnight. The telegraph has not been extended to Mergui. No large repairs to vessels can be executed. There are no regular pilots for the harbour. The climate though warm and humid is considered healthy. Annual rainfall is about 165 inches. Variation of temperature small.

Trade.—The chief exports are tin, timber, spices, rice, drugs and hides, value Rs. 600,000. The chief imports, silk, cotton, piece goods, tobacco and oils, total Rs. 475,000.

There is a hospital into which seamen are admitted, an entrance fee being paid by the master of the vessel; Rs. 15 for vessels under 300 tons, and Rs. 25, below 1,000 tons.

Water.—The best fresh water for a ship is from the waterfall near the north point of Madramakan island, obtainable at high water; that from the wells of Mergui is of poor quality.

INNER ROUTE TO MERGUI for steam vessels from the northern ports of Burma, is to pass eastward of Tavoy island, keeping about 2 or not more than 3 miles from it, in order to avoid the shoal water which extends 6 miles off the mainland. Canister bank, high and rounded, and Long island, also high, on the eastern side of the fair channel, are excellent marks, and so are Iron island, Great and Little Canisters to the west, and King and Plantain islands to the south, by the bearings of which, a vessel's position can be readily determined.

Amyinpoma islands, 2 miles in length, are a pair of small islands lying close together in a north-west and south-east direction. The northern is of conical shape, 529 feet high, the southern is 370 feet in height.

Bowers reef, a rocky patch, half a cable in extent, and drying at two thirds ebb, lies $9\frac{1}{2}$ miles, S.S.E. $\frac{1}{2}$ E. of Canister bank, and $5\frac{1}{2}$ miles N. $\frac{3}{4}$ E. from Long island.

Long island is high and narrow, appearing round from the northward and southward; there is foul ground 6 cables off its west side. Cone island is a small conical islet 138 feet high, and lies three quarters of a mile E.S.E. of Long island, with foul ground south-west of it.

Three quarters of a mile N.E. from Cone island is another group of rocks, 8 feet above high water.

Kawdwé rocks, a small patch of rocks just above water, lie $2\frac{1}{2}$ miles south of Long island, and mark the eastern limit of the channel.

Pyin-ban islet, 82 feet high, lies $3\frac{1}{2}$ miles S.E. from Long island. It is bare and from it a chain of islets and rocks extends southward for $7\frac{1}{2}$ miles to Barn island. From one to 2 miles eastward of this group, there is another and higher chain of islands, 2 to 4 miles from the mainland, which appears high from the channel.

Barn island is a square precipitous rock, 86 feet high. Cap rock, 22 feet high and small in extent, lies $1\frac{1}{2}$ miles N.W. $\frac{3}{4}$ W. from Barn island.

The western sandbank off the Kiaupi river, lies S.S.W., nearly 3 miles from Barn island. It has 5 feet over it at low water spring tides, and is close to the channel leading to Mergui.

DIRECTIONS, from the northward.—King, Plantain and Iron islands, show as one lofty island from the northward. When Long island is abeam and Iron island disengages from the others, steer for the left extreme of Plantain island, which is steep, in line with Kala-gyun (low) bearing S. by E. When Barn island bears E.S.E. steer for Madramakan or Pataw peak, bearing about S.S.E. $\frac{1}{2}$ E., until Little Canister is in sight between Plantain and Iron islands. Keep this mark on, or if too thick to see Little Canister, do not allow Plantain and Iron islands to close one another, until the beacon about a mile north-west of the north-west part of Mergui island is sighted.

Sandawut hill, 700 feet high, easily known by a conspicuous gap towards its southern end, lies $4\frac{1}{2}$ miles E. by S. from Kalwin point; the gap kept S.E. by E. $\frac{3}{4}$ E. will clear the beacon to the northward.

By night, a vessel after passing Long island, may run on until she picks up soundings on the bank stretching off the entrance to Mergui, when she should anchor until daylight.

For Mergui harbour.—No stranger should attempt to enter until after the first quarter flood if 10 feet draught, or till after half flood if drawing more than 10 feet. At neaps, a vessel of 15 feet draught may enter after first quarter flood. Steer to pass eastward of the beacon (pole and basket) at a distance of $2\frac{1}{2}$ cables, and then shape course S.S.E. $\frac{1}{4}$ E., with a white-washed basket on the mangroves about one mile north of the town, in line with a white-washed pagoda on the hill behind the town,* until the left extreme of the Commissioner's house bearing S. $\frac{3}{4}$ E. easterly comes nearly in line with the right extreme of the market (conspicuous white shed near the water's edge). From this position, which is $2\frac{1}{2}$ cables in the mangroves on Mergui island, steer for the Commissioner's house, till the right extreme of Madramakan island bears W. by N. $\frac{1}{4}$ N.; then the left extreme of the trees

* The pagoda on the hill at Mergui is a prominent object.

on Kalwín point* should now be kept astern bearing North a little easterly, this course taking the vessel 2 to $2\frac{1}{4}$ cables off the Mergui island shore, or steer to pass one cable west of the extreme of the main wharf, and anchor $1\frac{1}{2}$ cables W.S.W. or W.N.W. from it. These directions reversed will guide a steam vessel in leaving.†

A spit with 14 feet over it extends west of the end of the main wharf for $1\frac{1}{2}$ cables. By anchoring as recommended, this spit will be avoided, and vessels drawing not more than 15 feet, or more than 200 feet in length, will have swinging room at low water.

Rocks, low and shelving, extend about $1\frac{1}{4}$ cables from Madramakan island opposite to the main wharf, and under a small pagoda on a low hill. Several detached heads exist, and curtail the anchorage space, one of them drying $3\frac{1}{2}$ feet at low water springs.

TIDES.—It is high water, full and change, at Mergui at 11h. 9m. Mean springs rise 18 feet, and neaps 11 feet. Mean neaps range $4\frac{1}{2}$ feet. The tidal stream at half tide, at springs, runs about 2 knots during the dry season, the ebb is probably increased during the rains.

* A tripod beacon, on which it is intended to place a diamond or triangular shaped mark, has been erected near the extreme of the mud spit off Kalwín point, with Pataw peak bearing S. by W. $\frac{1}{2}$ W., distant $2\frac{1}{4}$ miles, and the beacon on the western shoals, W. $\frac{1}{2}$ N., distant $5\frac{1}{2}$ cables. (Commander A. Carpenter, R.N., December 1886.)

† In the south-west monsoon, sailing vessels bound from Coromandel coast or Ceylon to Mergui pass between Little Andaman and Kar Nicobar. From Bengal in the same season pass either side of Coco islands, and after passing Narkondam, steer for Tenasserim island, distant 45 miles W. $\frac{3}{4}$ N. from Mergui. The same island should be seen by ships which pass southward of the Andamans. After leaving Narkondam, soundings will soon be got near the islands off Mergui.

Leaving Mergui in the south-west monsoon, take every advantage to work to the westward clear of the islands, and pass through the Coco or Preparis channel, if bound to Bengal. Stand to the southward to clear the islands, if bound to strait of Malacca, Achi, or the Coromandel coast. If there is difficulty in getting westward of the islands, pass between the principal groups and the main. There is anchorage under many of the islands, but great vigilance will be essential.

From Bengal to Mergui during the north-east monsoon pass between Alguada lighthouse and Preparis; then steer to make Tavoy island, or the Moskos north-westward of Tavoy point, if the wind blow steadily from northward; then pass inside of Tavoy island towards Mergui, or westward of that island, between the islets off it and the Canisters, and afterwards between it and Iron island. In the strength of the north-east monsoon, ships from Coromandel coast should also endeavour to pass northward of the Andamans, and thence take every advantage to get to the eastward.

Departing from Mergui in north-east monsoon, pass through any channel between North Andaman and Alguada lighthouse, whether bound to Bengal or the Coromandel coast; but in February, if bound to Coromandel coast, proceed south of Little Andaman and make sure to fall in with the land to the southward of the destination, for southerly winds then prevail, with a current setting northward along the coast. Ships bound to Achi, after rounding the outermost islands of the Mergui archipelago, may steer direct for Golden mount (7,546 feet high) 25 miles eastward of Achi bay. If bound to the strait of Malacca, steer for Sayer islands, or the south end of Junkseyon.

The set of the flood stream between Long island and Fell passage, is to the southward.

South approach to Mergui :—The islands in the south approach to Mergui harbour are—

Thetyagi, a group of 4 islets, lying about $2\frac{1}{2}$ miles, eastward of the south end of Burnett island, the northern of which is rounded and has a small sand beach on it. A rocky ledge extends to the north-westward for 3 cables from the northern islet, and should be given a wide berth.

Pyin island, $2\frac{1}{4}$ miles to the northward of Thetyagi group, appears bold and steep-to, but in reality stands on a mud flat joining Bertie island which is all low mangroves, except a wooded hill at its south-east point, to Burnett island.

Thetyangai or Balu is bold and has a small summit at its south-west end, nearly detached from the rest of the island. The mud dries out all round this island at low water.

Maragi islands are bold and lofty; the highest summit 1,646 feet high and in shape pyramidal, is on the south-west island. The Maragi islands are useful in Fell passage, as leading marks. A shelving mud bank extends from their western sides, having over it only 3 fathoms, at $1\frac{3}{4}$ miles from the shore.

Two round islands lie off the south end of Burnett island; the bottom appears foul between them and the Maragi islands. A patch drying 9 feet shows at half tide, $1\frac{1}{4}$ miles East of the south end of the northern round island.

The channel into the south entrance to Mergui, passes between the northern of these two islands and Burnett island.

Limlor or Arabann island, 204 feet high, stands on the south-east corner of the mud flat off Bertie island, and opposite to the channel leading into the southern entrance of Tenasserim river, named Kwanthaung Wa. Good anchorage in 7 to 8 fathoms may be had immediately south of this island.

Letsari islands are both small and thickly wooded, the southern islet being twice the height of the other.

From South Letsari island which is conspicuous, a mud flat extends to within 2 cables of Falle island, which is the northern of several haycock shaped islets. This mud flat forms the boundary edge of the southern entrance into Mergui and the northern boundary of what appears to be a deep channel into Tenasserim river.

Directions, from the southward :—The south entrance to Mergui saves a detour of some 15 miles, to ships coming up the coast. It is however very shallow for 10 miles out from Mergui, there being only a foot

or two of water at low-water springs. Vessels drawing 8 feet can use it at high water, and if the banks were marked vessels of 12 feet draught.

When the south end of Cantor's island bears N.W. distant 2 miles, steer towards Shrub rock on a N.E. course, and when Shrub rocks bears North, distant three quarters of a mile, alter course to pass midway between the south end of Burnett island and the northern of the Round islands, with Shrub rock in line with the centre of Bound island, remembering that at springs the tides are strong in this vicinity. Then steer N.E. $\frac{3}{4}$ N. for $3\frac{1}{2}$ miles until the eastern extreme of Pyin island bears N. by E. $\frac{1}{4}$ E., when haul to E.N.E., passing $2\frac{1}{2}$ cables from the south end of Arabann island; when the south extreme of this island bears West, steer N.E. by N. towards North Letsari island. This channel is marked by fish traps on either hand and the course takes a vessel midway between them.

Above North Letsari island, the mud flats extending off Kan-bi-sat and Thitya islands nearly join, although there is a narrow channel between the islands, carrying 12 feet at high water neaps. The fishing stakes show the channel, and by keeping towards those on the Kan-bi-sat side, a vessel may pick her way across the flat.

The Kan-bi-sat mud flat has more water over it than the one on the opposite side. When off the centre of the entrance to Kan-bi-sat creek bearing East, steer for the summit of Kalé island on a N.N.W. course until just past the fish trap, when Pataw hill pagoda will bear N.E. by E. $\frac{3}{4}$ E., then steer for the north end of Pataw island to pass between the sand spit projecting $1\frac{1}{4}$ miles from the mangroves on the north-west side of Kanan island, and a patch of rocks named the Greenwich reef, that dries at half tide, lying $1\frac{1}{4}$ miles S. by E. of Kalé island. When past the sand spit, steer towards the south point of Pataw island, rounding it at a distance of $1\frac{1}{2}$ cables for the anchorage off the main wharf.

TENASSERIM,* a town on a neck of land at the confluence of the Great and Little Tenasserim rivers, 33 miles south-east of Mergui, is built on red sandstone rock along the slopes of a hill, amidst mountainous country. No traces of ancient greatness remain, and a few miles below the town, a reef of rocks stretches across the river, over which, even during the rains, no vessel drawing more than 6 feet can pass. In 1877, Tenasserim had dwindled down to a village of 666 inhabitants. The temperature is variable, and climate considered unhealthy.

TENASSERIM RIVER has several mouths, the two principal of which are separated by Mergui island. Large boats can ascend as far as Tenasserim town. The banks of the river are in places very steep, and the channel is in parts narrow. The tide is felt 10 miles above Tenasserim town.

* To vessels entering by this channel, Pataw hill is easily recognised, being the highest land opening about N.E. by N. on rounding Arabann island.

NAVIGATION BETWEEN MERGUI AND JUNKSEYLON.

FELL PASSAGE, used by vessels proceeding to the southward through the Archipelago, lies along the east side of King island; it is 19 miles in length and has a least depth of $2\frac{1}{4}$ fathoms at low water. In the centre however there is a narrow pass, in which it is difficult to avoid passing over $1\frac{1}{2}$ fathoms at low water. The channel is narrow and runs through the mud banks that lie between all the islands, but with a rising tide and attention to these directions, it is by no means difficult. At high water neaps, there is not less than 21 feet throughout its length.

Sa island, 322 feet high, is a steep islet lying close to the southward of the east bluff of Plantain island, and marks the north end of Fell passage. A stony shoal trending northward from Kala-gyun has its apex half a mile East of the north end of this island. Sa island should therefore be approached on a S.S.W. bearing, until within 2 cables, at which distance it should be passed on its east side, and a S. by W. course steered to pass in mid channel between Kala and King islands. After passing the western elbow of Kala gyun keep rather over to that island until the channel between Yemyok-gyun and King island opens, when gradually haul into the channel, keeping now to the western shore to avoid some lumps of $1\frac{1}{2}$ fathoms, in mid-stream.

Yemyok-gyun is covered with mangroves and has a spit that dries 3 cables off its north end. Keeping to the western shore, a large double creek that does not dry, will soon be passed, and a small round wooded islet (Sakoné-gyun) will be seen opening to the right of Yemyok-gyun. Altering course gradually bring the small islet to about twice its own breadth from Bare island, which has a rounded bare summit; but on no account let it close altogether, and running down on this bearing S. $\frac{1}{4}$ W., pass Bare island at one cable's distance, and haul S.S.W. for the Paye-gyun passage.

Another small islet Pigalé, will now be seen ahead, a passage exists either side of it. Short vessels prefer the eastern channel which is narrower but more direct, and easier when going to the southward. Rocky spits project from Pigalé islet to north-eastward and north-north-westward.

Pigalé passage.*—Going south, keep the east side of Bare island touching the west side of Yemyok-gyun, until the north end of Paye-gyun island is abeam, when starboard sufficiently to open the above islands apart. When the north end of the small islet bears W. by S. $\frac{1}{2}$ S., keep in mid-channel until through.

* A pole and basket has been placed at the end of the rocky spit trending N.E. from Pigalé islet, with north point of Pigalé bearing W. $\frac{1}{4}$ N. about one cable distant, and south point of Pigalé, S.W. $\frac{1}{4}$ W. distant $1\frac{1}{2}$ cables. Vessels should pass eastward of the beacon midway between it and Paye-gyun. (Commander Carpenter, R.N., December 1886.)

Going northward, round the north-east corner of Thanpo island at $1\frac{1}{2}$ cables distance, to avoid a shelving gravel bank off it, and steer for its north point, which is rocky, bearing N.W. by W., until the east side of Myi-ni which is next north of Thanpo island, is in line with the bare summit of Bare island, when haul to the northward, and skirting the island on the port hand, stand out N.E. by E. into the direct channel again. The shoal of $1\frac{1}{2}$ fathoms, in this channel is composed of gravel.

Continuing to the southward, the track leads to the opening between King island and the island off it, passing Thanpo island and the spit south of it, at $1\frac{1}{2}$ cables distance, and Gyun-thaung which has been partly cleared, at 2 cables. A shoal of sand and shells, lies in mid-channel, half a mile S.W. from the western extreme of Gyun-thaung, and has only $2\frac{1}{4}$ fathoms over it; it can be avoided by borrowing on the western side.

The track now leads midway between King island, and Burnett, Fell and Passage islands. Between the first named the eddies at springs are strong.

The south end of King island, terminates in a bay, between the headlands of which, it shoals rapidly.

Water can be procured on King island, opposite the north end of Fell island, but the mouth of the stream requires looking for.

Burnett and Fell islands.—Burnett island is low and irregular compared to Fell island, which is 797 feet high and has two summits, the western of which is the higher. Fell island is frequently visible from the passage and is useful for leading marks.

The Lah-chi islets, a group of five, lying to the south of this island are of conical shape and moderate height, the northern islet being the highest.

Passage island 370 feet high, has a nearly level summit with a slight saddle in the centre. A mud bank of $2\frac{1}{2}$ to 3 fathoms extends westward from it.

TIDES.—In Fell passage the flood enters at both ends, meeting at about Ngathok, where it takes an easterly direction through the creek between Kala-gyun and Mai-aing islands. Between Passage and Christmas islands the general set of the flood stream is easterly. In the vicinity of Shrub rock, the indraught of the flood is very strong at springs, towards the dangers laying on the eastern side. The diurnal inequality is large, the tide lagging at neaps for 2 hours and gradually lessening to half an hour towards springs. Inside Fell passage it is high water, full and change, at the same time as at Mergui.

BENTINCK ROUTE.—Pass Passage island at a distance of 5 cables, and bring the south point of King island in line with the sharp peak of Maingy island N.N.W. Then steer S.S.E. keeping this mark on, and pass one mile clear of Shrub rock. When Shrub rock, 23 feet high with a single bush on it, bears N.E., steer S.W. $\frac{1}{4}$ W. until the south extreme of antors island bears N.W. about $1\frac{3}{4}$ miles distant, and Mouse islet (173

feet) is in line with the sharp peak of Polly island. Then alter course to S.W. $\frac{1}{2}$ S. to pass about a mile to the north-west of Christmas island. The double peak on the south end of Ross island, kept well open of the south extreme of Cantors island, clears the shoals extending to the eastward of the latter.

In passing between Cantors island and Hext rock care must be taken that the vessel is not set to the southward.

Small vessels may cross the banks by keeping the east side of Passage island open of Fell island, seeing daylight between them.

Polly island has a conspicuous peak 727 feet high which kept shut in by the summit of Cantors island clears Hext rock to the westward.

Hext rock, $2\frac{1}{2}$ cables in extent, has $1\frac{1}{2}$ feet over it at low water springs and is generally indicated by a ripple. From the rock the south point of Cantors island bears N. by W. $\frac{1}{4}$ W. distant $4\frac{1}{4}$ miles. The summit of Bentinck island kept open westward of Christmas island, leads clear to the westward of the rock.

Cantors island, somewhat low and irregular, is $1\frac{1}{2}$ miles long north and south; a rock having only 6 feet over it at low water springs, lies $1\frac{1}{3}$ miles E.N.E. of its south point. There is foul ground between this rock and the island.

Bound island, lying $2\frac{1}{3}$ miles N.E. of the north point of Cantors island, is 203 feet high and rounded. A small conical islet named Mouse, 173 feet high, lies one mile West, and a rock above water $1\frac{1}{4}$ miles S.W. of Bound island.

Medina patches,* lying one mile East of Bound island, are composed of gravel and have only $1\frac{1}{2}$ fathoms over them at low water. The shoal is altogether 8 cables long N.W. and S.E., and lies on a bank of 4 fathoms, sand and mud.

ROSS ISLAND presents no remarkable features except the double summit at its south-east point.

Water.—Very good water can be obtained in boats at half tide, at Waterfall cove, which lies one mile W.S.W. from the north end of Helfer island. Boats at half tide can lie underneath the water, which falls into the sea.

Christmas island consists of 3 islets and several patches of rock. The summit, 466 feet high, is on the western islet, which may be passed on its west side at a distance of half a mile. To the north-east and south-east several patches of shoal soundings have been found.

Single rock, a boulder 10 feet above water, lies $2\frac{3}{4}$ miles N.E. by E. from the north extreme of Christmas island, and must be guarded against if steering southward by night on a flood tide.

* Reported by Mr. E. C. Russell, master of the steamship *Medina*.

Tides.—It is high water, full and change, at Christmas island at 10h. 29m., extraordinary springs rise 16 feet.

THE COAST, southward of Mergui, is low and swampy in places. Several rivers, navigable only by boats, find their way to the sea through narrow channels bounded by flats. The elevated ridges or hummocks are generally covered with large trees, many of these formerly appear to have been islands, which have become united by the soil brought down by the rivers.

Auckland bay.—The north end of Sellore island, which is 13 miles S.S.E. from the south end of King island, forms, with the land to the eastward, Auckland bay, well sheltered, and having anchorage over it in from 4 to 12 fathoms, mud. Auckland bay is not readily accessible to strangers, and is rarely entered without the aid of a native pilot.

DIRECTIONS.—Borrow on West Passage island, where there are depths of 5 or 6 fathoms; towards Cap and Feather islet, the water shoals to 3 and 2 fathoms. Pass West Passage island at a distance of not less than 2 cables, and South Passage island at one mile. Then steer S. by W. for 22 miles, passing between Bushby island and the group named the Five Sisters.* Being between 2 and 3 miles west of Bushby island, steer about S.S.E. $\frac{1}{2}$ E. to pass between High and Sullivan islands. On this course the flood sets to the eastward, some allowance must therefore be made for the tidal stream.

ANCHORAGES.—During the dark rainy nights which occur in the south-west monsoon, a steam vessel from the northward might conveniently anchor 2 miles to leeward of Bentinck island in 6 or 7 fathoms, and equidistant from South and West Passage islands. Advantage may, on similar occasions, be taken of the good anchorage in Forrest strait to leeward of Sullivan, and S.S.W. of High islands, where there are depths of 8 or 9 fathoms.

FORREST STRAIT.—**Caution.**—Great care is necessary in the navigation of the Mergui archipelago, especially in Forrest strait, and near the Gregorys, where several rocks have been discovered of late years.

The Gregorys are five low-level tree islands, on a white sandy base, the northern one of which is 18 miles to the south of High island. Vessels should pass about 1 mile to the eastward of the Gregorys.

DANGERS.—**Marble rock.**—A sunken rock, lying about $2\frac{1}{2}$ miles northward of Gregory islets, and 2 miles westward of the fairway of

* This course, it should be remembered, passes about one mile westward of *Fly* rock, which lies about 7 miles S. $\frac{1}{4}$ E. from the south point of Bentinck island, and sometimes breaks.

the strait, reported by the master of the steam vessel *Kurrachee*, has been noted on the charts as Marble rock, from which the bold promontory, of Sullivan island, bears W. by S. $\frac{1}{2}$ S., North Gregory S.S.E. $\frac{1}{4}$ E., Canister islet N.E. $\frac{1}{4}$ N.

Boyce shoal. — The steam vessel *Madras* passed over a small shoal (Boyce shoal) on which there is a depth of 2 fathoms at low water. It lies between Boyce hill and the main body of the Gregorys, and there is a space of little more than 2 miles between the latter and the shoal. Caution is necessary, and it is prudent to borrow towards the Gregorys.

Kurrachee rock, on which that vessel was wrecked in July 1877, is a dangerous pinnacle with 5 feet on it at low water, and 7 to 12 fathoms close around, deepening to 16 fathoms at the distance of half a cable. The rock lies in mid-channel, with the centre of largest Gregory islet bearing W. by N. $\frac{1}{2}$ N., $1\frac{3}{4}$ miles, South Gregory S.W., $\frac{1}{4}$ W., $3\frac{1}{2}$ miles, and Turret islet S.S.E. $\frac{1}{2}$ E., $7\frac{3}{4}$ miles.

A rock with less than 6 feet on it, lies S. by W. $\frac{1}{4}$ W., nearly one mile from Kurrachee rock.

Beyond Boyce shoal and the Gregorys, a South course for about 23 miles will lead 2 or 3 miles to the eastward of Five islands, from which position alter course to S. by W. westerly, to avoid the extensive flat of sand and mud lying off the entrance to Pakchan river, for directions for entering which see page 344.

OUTER OR WESTERN ISLANDS, of the Mergui archipelago, extend about 60 miles from Tenasserim island (described at page 322), between the bearings of S. $\frac{1}{2}$ W. and S.S.W. They are generally of similar appearance, high, steep, and covered with dense foliage, but until properly surveyed, the channels between them cannot be pronounced free from dangers.

Oubliée rocks, one about 12 feet high and the other awash, about a mile apart, north-west and south-east, lie nearly $2\frac{1}{2}$ miles northward of the north-west point of Elphinstone island, and 3 to 4 miles N.E. by E. of Saddle island, with 15 fathoms between them and Elphinstone island.

Great Western Torres islands form the westernmost group of the Mergui archipelago. The two larger islands are separated by a channel, which is one cable broad at the south end, and 3 cables across at its northern entrance, with depths from 17 to 35 fathoms, except at its narrowest part, where it shallows to 7 fathoms, coral and sand. At this point the fringing reef on either shore narrows the passage to 50 or 60 yards. Half way through, there is a deep cove running back about 3 cables into the western island, with depths from 17 fathoms off the mouth, to 7 fathoms near the head which is filled with sand. Coral fringes both sides of the cove, but a short vessel in need of repairs or fresh water can

moor within it, the fresh water always running at the head. Longer vessels can anchor off the cove in 15 to 18 fathoms, but the holding ground is slight and the anchorage exposed to the swell.

To enter.—Bring the north entrance to bear S.E. $\frac{1}{4}$ E. when the nearest Little Torres island will be visible through it; steer in keeping the island in sight until the cove opens on the starboard hand, when anchor where suitable.

Tides.—It is high water full and change at 10h. 19m.

Little Torres islands are a group of four islets, averaging 270 feet in height. The south-west islet is double, and has a needle-shaped rock off it. They should not be approached within 3 miles.

Tower rocks on the north point of Prinsep island are an excellent landmark, visible 20 miles on a clear day, but Sargent island being higher than Prinsep island, may perhaps render them indistinct when viewed from the north-westward.

Sir John Hayes island is high, and Fletcher island nearly joined to its south end is low. Deep water has been found close to the eastern shore.

NEARCHUS PASSAGE.—To enter the archipelago in this latitude, the passage recommended is that between Great Western Torres and Sir John Hayes island, and thence to the northward of Bentinck island.

Pass 2 miles north of Great Western Torres and $1\frac{1}{4}$ miles south of Fletcher island, then stand for the passage between Courts island and Bentinck island. From this direction the summit of Courts island appears as a volcanic cone and the peak on Bentinck island is not conspicuous. On nearing Courts island keep somewhat over towards it, and thence steer N.E. for Christmas island, passing 3 miles north-westward of Warning rock, which only uncovers at half tide at springs.

A black rock, visible 8 miles, lies about $16\frac{1}{2}$ miles S.E. by S. of Little Torres islands, or in about lat. $11^{\circ} 23' N.$, long. $97^{\circ} 40' E.$

Nearchus rock, which covers at high water, is situated nearly 14 miles E.S.E. of Fletcher island, and $8\frac{1}{2}$ miles from the western shore of Bentinck island; around it are depths of from 31 to 35 fathoms.

BENTINCK ISLAND is 15 miles in length N.N.W. and S.S.E. by $3\frac{1}{2}$ miles in breadth. The peak near the north end is about 900 feet high and appears as a horn when viewed from the north-eastward. On its eastern side there is excellent anchorage in 8 to 9 fathoms. The best spot, in Bentinck harbour, is at about 2 miles northward of South Passage island, where the bottom is of sand and mud. Caution is necessary in approaching this anchorage on account of possible sunken dangers.

From the southward, give the south end of Bentinck island a berth of 3 miles to avoid some islets (one of which is perforated) and a reef above water, lying off it, at a distance of $2\frac{1}{2}$ miles. Thence in coasting the east side of the island, avoid the Daphne rocks. These rocks are just covered at low water, and consist of several large boulders nearly one mile distant from the mouth of a small creek, with 9 and 10 fathoms between them and the land. From them, the south-east extreme of Bentinck island bears S. $\frac{3}{4}$ E., and the mouth of the small creek, W. $\frac{3}{4}$ N., or in 'about lat. $11^{\circ} 42' N.$, long. $98^{\circ} 7' E.$ South Passage island should be passed on its eastern side, and a W.N.W. course will then lead to the anchorage.

From the northward, Warning rock (awash at half tide) and a rock 15 feet above water, S. by E. 2 miles from it, lie in the channel. Having cleared these, pass between West Passage island and Cap and Feather islet, and thence to the south-west for the anchorage.

The rise of the tide in Bentinck harbour is about 9 feet.

Warning rock, already alluded to, lies $4\frac{1}{2}$ miles E. by S. $\frac{1}{2}$ S. from the south-east point of Courts island, and uncovers at half tide, at springs. There is a depth of 10 fathoms, a mile to the northward, and no bottom at 13 fathoms half a mile eastward of the rock. The channel between Warning rock and the reef surrounding the rock 15 feet above water, appeared to be clear.

Fly rock, about one mile eastward of the track of vessels taking the route between Five Sisters and Bushby island, is said to break at times. From it, Fly island bears S.E. by E. $\frac{1}{2}$ E., and the north-west point of Bushby island S. $\frac{1}{4}$ E.

Anchorage in case of necessity may be had in about 15 fathoms midway between Eliza island (of the Five Sisters group) and Bushby island. The course thence to the anchorage off the north-east end of Sullivan island is about S.S.E. $\frac{1}{2}$ E., and the distance 29 miles.

DOMEL ISLAND, about 8 miles eastward of Bentinck island, is 23 miles in length in a N. by E. and S. by W. direction, with an average breadth of 4 miles. It is mountainous; the summit about 2,240 feet high, distant 10 miles from the southern end, being visible at a considerable distance from seaward. Off the north end, extending in a northerly direction, are Money, Trotter, and Parker islands, besides numerous small islets and rocks.

Kisseraing island, eastward of Domel, is a large island 18 miles long and 10 miles broad, and considered one of the most fertile of the Mergui archipelago. The channel on its west side is shallow and narrow, and that on the east side is almost dry at low water.

Whale bay, between the south-east side of Kisseraing island and the coast, is a spacious anchorage, the approach to which is from the south-west. The survey of 1828 shows anchorage in from 6 to 8 fathoms in the

eastern part of Whale bay, but the approaches have only been partially examined and should be cautiously navigated. A colony of Malays was established (1832) at Cheding on the south-east side of Whale bay, at that time the only village on the coast for many miles.

Lenya river enters the head or north-east part of Whale bay, and is said to flow through a fertile country; coal was reported to be found 30 miles from the sea.

Bokpyin creek, in lat. $11^{\circ} 17' N.$ dry at low water, flows through a fertile, but thinly peopled country. Southward of it, distant about 10 miles, is an extensive group of islands, with shallow channels separating them, of which but little is known. From thence southward, high land borders the sea as far southward as Pakchan river.

Son and Father are two barren rocky islets, of which Father is the highest (584 feet), distant 8 miles S.S.E. $\frac{3}{4}$ E. from Charlotte, the south island of the Five Sisters. Some rocks above water lie about a mile N.N.W. of them, and there is also a group of rocks above water between them and the Sisters, at about $2\frac{1}{2}$ miles from the latter.

Forrest passage, between Father and Son islets and Sullivan island, is about 22 miles wide and affords an approach to Forrest strait from the westward. Overfalls are met with in Forrest passage indicating a change in the nature of the bottom. The tidal streams set, flood to the east and ebb to the west, about $2\frac{1}{2}$ knots, at springs.

High island, in the eastern part of Forrest passage, about 2 miles in extent, and in lat. $11^{\circ} 2' N.$, long. $98^{\circ} 19' E.$, has fresh water on its north-east side. A shoal was reported in 1876 to exist about 3 miles N.N.E. of the northern extremity of High island.

Clara island about 5 miles in extent N.N.E. and S.S.W., has a sharp peak to the southward, and tapers to a point at its south end, southward of which, distant nearly a mile, is a small but high islet, called South Sentinel. The highest or northern part of South Sentinel island, is about 1700 feet above the sea.

North Sentinel, a small islet having a rock near its south-west side, bears about N.E. $\frac{3}{4}$ N. distant $1\frac{1}{4}$ miles from the north-east point of Clara island.

SULLIVAN ISLAND, or Lampí, of irregular shape, extends in a curve N.N.W. and S.S.E. for about 19 miles, and turns suddenly from its northern part, near to which is a sharp peak, to the south-west for 7 miles, being separated from Blunt island by a narrow channel. At its south-west end is a hill 1,173 feet high, southward of which fresh water appears to be obtainable, and anchorage in 7 fathoms about half a mile from the shore. The island does not exceed a breadth of $3\frac{1}{2}$ miles in any part. The summit, 1,521 feet high in about lat. $10^{\circ} 48' N.$, is $6\frac{1}{2}$ miles from

the southern extremity of the island. There is also anchoring ground inside a string of islands on the western side of Sullivan island, and fresh water obtainable. A pearl bank of some extent is said to exist off the western side of the island.

The east coast of Sullivan island is dangerous to approach closely in several places. About 3 miles northward of the east point of the island and $1\frac{1}{2}$ miles off shore, is Half moon shoal, which covers at high water and should be avoided by vessels passing through Forrest strait, for the passage through which and present known dangers see page 332.

North and South Twin are of small dimensions and have scarcely been examined. They are the westernmost of the islands of this part of the Mergui archipelago, and their approximate position is North Twin, lat. $10^{\circ} 38' N.$, long. $97^{\circ} 42' E.$; South Twin, lat. $10^{\circ} 28' N.$, long. $97^{\circ} 41' E.$, about 10 miles apart on a north and south bearing.

Great Swinton islands are near to each other, and stretch E.N.E and W.S.W. for about 7 miles. The westernmost island bears S. $\frac{1}{2}$ E. distant nearly 20 miles from the south peak of Clara island. The following small islets on about a N.N.E. bearing, stretch from the Great Swinton islands. Islet with rock westward of it at 4 miles, Red islet at 10 miles, Brown islet at 13 miles, and Ninepin rocks at 15 miles. Ninepin rocks bear South, distant 3 miles from the islets off the south point of Blunt island.

Loughborough passage, lies between the Great Swinton islands and Loughborough island, and is about 2 miles wide. H.M.S. *Dryad*, in February 1871, steamed down the north-east side of Loughborough island about three-quarters of a mile off-shore, with soundings of 17 to 19 fathoms, clay. Nearly abreast of the east point of the island, with Northern Pap bearing S.W. by W. and half a mile from the shore, is Hayward island, with rocks extending off it, off which the *Dryad* anchored in 17 fathoms clay, good holding ground, with South Pap S. $40^{\circ} W.$, and Skinner island on with Quoin island S. $45^{\circ} E.$ *

Between Loughborough and Richards islands (to the east), is good anchorage in 8 to 15 fathoms mud, with 3 fathoms close to either shore.

Pollock reef.—The steam vessel *Madras*, in 1875, passed between Loughborough and Swinton islands. Here, in mid-channel, a rock above water and a sunken reef were found, and the vessel narrowly escaped striking. The sunken or Pollock reef, is in about lat. $10^{\circ} 30' N.$ and long. $98^{\circ} 0' E.$ The passage between Loughborough and Swinton islands should therefore be avoided.

O'Connor, Saul, and Skinner islands lie from one to 2 miles eastward of Richards island. They are of irregular form, each about

* Remark Book of Navigating Lieutenant W.H. Hayward, R.N., H.M.S. *Dryad*, 1871.
U 18887. Y

half a mile in diameter, and said to be dangerous to approach on account of rocks. Vessels passing between them and Richards island, should keep nearer to Richards island; the *Dryad* obtained 16 fathoms in this channel when west of Skinner island.

Birds Nest island.*—There are several islands situated on the south-east side of Loughborough island. The largest of these, on the south part of which are several caverns in which edible birds nests are procurable, is distant about 5 miles, south-east of Loughborough island. Birds Nest island is reported to be only 60 feet wide in its central part.

St. Andrew islands, about 6 miles southward of Birds Nest island, are numerous, with six principal islands named after the letters of the alphabet A to F.

Horsburgh island (or E) of this group, is the north-western, and visible about 20 miles.

Cockburn islets are situated from one to $2\frac{1}{2}$ miles northward of C island, and are in line on a S. $\frac{3}{4}$ W. bearing.

Parsons rock, consisting of pinnacles which uncover 3 to 4 feet at low water, is situated E. $\frac{1}{2}$ N. distant nearly 2 miles from the north Cockburn islet. The east point of Birds Nest island bearing North, or a conspicuous round island covered with jungle off the east side of C island bearing South, clears to the westward of Parsons rock.

The *Dryad* anchored in 13 fathoms, sand, to the north-east of the north point of C island, but in bad holding ground.

ST. MATTHEW ISLAND.—About E.S.E. from St. Andrew islands and midway between them and the mainland are St. Luke, St. Matthew, Hastings, and other islands, the largest and most important of which, St. Matthew, is 16 miles long and 6 to 8 miles broad. Nearly 3,000 feet high in its central part, it is visible for a considerable distance. Wild hogs and pigeons abound, and fresh water may be had except when an unusually dry season prevails.

Hastings harbour,† formed by St. Luke, Hastings, and the north shore of St. Matthew islands is an extensive sheet of water affording excellent sheltered anchorage in 5 to 8 fathoms, mud. There are two entrances, one to the north-west and the other to the south,‡ of Hastings island, for the navigation of which the chart is the best guide. H.M.S. *Cossack* anchored here in April 1871, with Haycock bearing N. 12° W.,

* See Admiralty chart No. 216b, Mergui archipelago, Sayer island to Loughborough island.

† See Admiralty plan of Hastings harbour, No. 91; scale, m = one inch.

‡ Care is required in entering by this channel, for a dangerous patch of rocks of 12 feet lies about half channel over from St. Matthew island towards Hastings island; also a rocky reef lies off the south point of Hastings island, nearly a mile, for which the lead gives no warning.

and south point of Hastings island N. 73° E. The heat was said to be great, the water smooth, and the jungle dense; tracks of large animals and elk, were seen on the beach. On St. Matthew island, some fine straight timber was noticed; the Sellonese visit this harbour occasionally.

Tides.—It is high water, full and change, at 10h. 40m.; springs rise 14 feet. The strength of the stream of tide at springs, is about one knot.

Fish harbour is a small bight in the north-east side of St. Matthew island, about 2 miles southward of the southern entrance into Hastings harbour; it is available for craft of less than 9 feet draught only. Off the entrance, distant about a mile, is a small white rock with deep water around it.

Pine Tree island is a good object to steer for, when passing out of Hastings harbour by the channel north-west of Hastings island. It is distant 11 miles N. by E. from the channel, on which bearing it appears midway between Russell island and South-east Hump; it is a mile in extent, and reef projects from its north, west, and south-west sides for nearly a mile.

South-east Hump and Five islands.—S.S.E. 4 miles from Pine Tree island is South-east Hump, a small bold islet. Five islands, on a narrow reef $1\frac{1}{4}$ miles long, are distant a little more than 2 miles, E. $\frac{1}{2}$ N. to N.E. by E. $\frac{1}{4}$ E. from South-east Hump; the north island is $4\frac{1}{2}$ miles S.E. $\frac{3}{4}$ E. from Pine Tree island. Undiscovered dangers may exist in the vicinity of South-east Hump and Five islands.

Aladdin islands, south-westward from St. Matthew, are a scattered group 18 miles in extent. Some of the islands are high and bold.

Davis island, 4 miles from the south-west end of St. Matthew, and one of the largest of the cluster, is nearly 4 miles in diameter and visible 20 to 25 miles.

Dunkin island, 3 miles E.S.E. from Davis, is also high; at half a mile from its east side is a depth of 10 to 20 fathoms.

Western Rocky island, the outermost, is less than a quarter of a mile in extent but of considerable height, being visible 12 to 15 miles; its approximate position is in lat. $9^{\circ} 52' N.$, long. $97^{\circ} 52' E.$

North Rocky island, $5\frac{1}{2}$ miles E.N.E. from Western Rocky island, is in about lat. $9^{\circ} 54' N.$, long. $97^{\circ} 57' E.$

Haycock, another isolated rock $10\frac{3}{4}$ miles S. by E. $\frac{1}{4}$ E. from Western Rocky island, and 9 miles S.W. from Davis island, is in about lat. $9^{\circ} 41' 10'' N.$, long. $97^{\circ} 54' E.$ The three last-mentioned islets are the farthest to seaward of the Aladdin group. Soundings carried from the west side of Western Rocky island to about a mile from the west side of Haycock, showed the depth off this part of the Aladdin group to be from 25 to 31 fathoms.

Christie island, the southernmost of the Aladdin group, is of irregular form, and off its south and south-east sides are some rocks above and under water.

Auriol, the south-eastern island, is probably bold, there being 16 fathoms water at a short distance from its east side.

Chance island.—Ten miles S.S.W. from Christie is Chance island, of irregular form, and having several rocky islets in its immediate vicinity. It is 5 miles in extent S. by W. and N. by E. and 3 miles across at its north end, which is the broadest part. Its peak is visible upwards of 30 miles. Some rocks above water are situated off its south-east side. Chance island should not be closely approached, having been only cursorily surveyed. The depth at about 10 miles from its west side is 44 fathoms, midway between it and Middle island, 46 and 47 fathoms, and at about a mile from the islet off its south end, 33 fathoms.

A rock marked "doubtful" and said to exist about midway between Christie and Chance islands, has been reported and placed on the chart.

Richelieu rock, awash at low water, is nearly midway between Chance island and the coast. From it the peak of Chance island bears about W. by N. $\frac{1}{4}$ N. distant 14 miles. This rock is said to be smooth and oval in shape, about 100 feet long, and in appearance like a ship turned bottom up; in its vicinity is a depth of 17 to 20 fathoms.

Middle island.—Between Chance and Perforated islands, on the bearing of S. $\frac{1}{2}$ W., distant 18 miles from Chance island, is Middle island, $1\frac{1}{2}$ miles in extent, and lofty enough to be visible from a vessel's deck, at the distance of 25 miles.

Perforated island.—From Middle island, Perforated island (so named on account of a hole through it) is distant 14 miles in the direction of S. $\frac{1}{8}$ W. The depth at a mile from its east side is 46 fathoms.

SAYER ISLANDS.—This group is the southernmost of the Mergui archipelago, and consist of nine islands, densely wooded and steep-to, with the exception of the north-east coast of South island, off which a reef extends one cable.*

Great Sayer island (Pulo Tajah) is 2 miles long, north and south, half a mile wide, and rises at the northern part to a height of 802 feet. At the north-east point is a small cove, with 7 fathoms water in it. North island, situated 4 cables north of Great Sayer island, is 326 feet high, and in the channel between these islands are depths of 23 fathoms.

Channel rocks, from 15 to 20 feet high, lie $5\frac{1}{4}$ cables S.W. by S. from the south-west point of Great Sayer island, and are steep-to.

* Remarks by Commander Hon. F. C. P. Vereker, H.M.S. *Magpie*, 1884. See Admiralty chart :—Sayer islands to Bass harbour, No. 842.

Centre islands are four in number; the northern is conical shaped and 392 feet high; the southern island of the centre group is 447 feet high, and has two smaller islands nearly connected by a reef situated off its north-east point. In the channel between, there is a depth of 8 fathoms.

Payan island, situated one mile north-east of Sangasiap island, is 151 feet high, and of conical shape.

Sangasiap island, 428 feet high, is $2\frac{1}{2}$ cables broad at its south-west extreme, and narrows gradually to Andrew point, which is broken and clifty, and 59 feet high.

South island, has a double summit, the peaks being 385 feet and 368 feet high, respectively. The sand beach on the north-east side is fronted by a coral reef extending one cable off shore. The observation spot at the eastern end of the beach is situated in about lat. $8^{\circ} 29' N.$, long. $97^{\circ} 39' E.$

Taku rocks, consist of three rocky heads which cover at high water springs, and a few detached rocks, all being steep-to.

Tides.—In the month of January 1884, high water, full and change, was observed to be at 10h. 0m. (approximately), springs rise about 8 feet.

In the channel between Sangasiap and South island, the flood stream set to the East, and ebb to the West, while outside, the tidal streams appeared to set N.E. and S.W.

COAST OF SIAM.*

PAKCHAN RIVER, which separates British territory from Siam, rises in lat. $10^{\circ} 48' N.$, long. $98^{\circ} 56' E.$, and is about 78 miles in length. For about 30 miles, as far as the Siamese village of Kra, the direction of the river is south-west, above this it becomes tortuous. At Kra the stream is 250 feet broad, and gradually increases in width towards its mouth, where the distance across is about 2 miles.†

Between Goh Phi and Victoria point are depths of from 10 to 12 fathoms. The river is densely wooded on both sides, and numerous small rivers and creeks debouch into it. The principal of these, on the British side, is Maliwun river, and on the Siamese side, Klong Bang Pra, Klong Raun, and Klong Lam Lieng. Maliwun is a small town famous for its tin mines, situated amongst high hills about 12 miles from the entrance to

* The information relating to the coast of Siam is chiefly by Commander A. D. Taylor, (late I. N.), and Commander A. de Richelieu, of the Siamese Imperial Navy.

† In the rainy season of 1864, H.M.S. *Nemesis* succeeded in reaching Kra.

Maliwun creek, and about 25 miles from the entrance to Pakchan river. Vessels of the British India Steam Navigation company call at Maliwun once a month, sometimes anchoring about 5 miles up Maliwun creek, and at others, off Renong river on the Siam side.

Renong river is small, narrow, and shallow; at its mouth is a small island named Goh Phi, to the southward of which is the deepest entrance channel. Having entered the river between Victoria point and Victoria island steer to the eastward, when the mouth of Renong river will be visible, and anchor in 4 fathoms (low water) with the small rocky islet Goh Phi bearing N.E. by N. distant 2 cables, and Victoria point bearing N.W. by W. $\frac{1}{4}$ W., Long island being visible through the opening of the river, and the high peak of St. Matthew island just over the north point of Victoria island. At this anchorage the outline of the bank (that dries at low water spring tides) is visible to the south and south-east. The bottom composed of stiff clay is good holding ground.

About 4 miles up the river is a landing place, whence a road leads up to the Rajah's residence (about one mile from the river), but boats can only ascend to this landing place at high water, as the creek dries at low water. The town of Renong is steadily increasing in importance, and around the town are large tin mines, from which a great quantity of tin is exported. There is fortnightly communication with Penang and Rangoon. Fresh water and all kinds of provisions may be obtained at reasonable prices; also firewood.

Round, or Funnel mountain, on the mainland 18 miles south of Renong, has a conspicuous peak.

Victoria point at the south extreme of a long range of mountains (Maliwun hills), is a high bold point, on which the trees have lately been cut down; it is steep-to, and the channel between it and Victoria island is deep and safe.

Goh Phi is a small rocky island, situated about 2 miles north-east from Victoria island, and only a few cables distant from the entrance to Renong river. There is deep water to the north and west from it, but to the eastward, it is connected with the mainland by sandbanks; and to the south, extending in a S. by W. $\frac{1}{2}$ W. direction, is a sandbank marked by a buoy. The channel into the river is south of this buoy, and the water shoals gradually towards the mouth of the river, from 5 fathoms westward of the buoy, to $1\frac{1}{2}$ fathoms on the bar.

Victoria island, a large, low, wooded island of triangular shape, is one mile south of Victoria point. From the mainland to the eastward, large sand banks extend towards this island, and the deepest water is about 2 to 3 cables from the island; to the southward and westward the island is surrounded by large sandbanks, but along the north side is deep water (from

8 to 12 fathoms) a few cables off, in the channel above-mentioned between it and Victoria point. Off the north-west point is a small low island.

Mostyn, Festing and Dyke islands* to the northward of Saddle island are low and wooded ; they are at low water all connected by sandbanks, and by the Siamese are considered as one island and named Goh Son ; between these islands and the sandbanks extending from the mainland, is a good channel, in which the depths vary from 4 to 6 fathoms at low water.

Saddle island (*Siamese* Goh Chang) is the largest of the islands along this coast, as it is also the highest ; it is about 5 miles long by a little over 2 miles broad, and the highest peak in the middle of the island is in latitude $9^{\circ} 50'$ N. From the east coast of this island, as well as from the mainland opposite, large sandbanks extend, between which there is a channel, but neither broad nor deep, and it is difficult to find at high water ; at low water the sandbank dries on both sides. Off the south-east point are some small wooded islands, and a sandbank extends along the whole of the south coast of the island. The west coast is the highest, and close to it lies a small, low, rocky island (Tree island) with some small trees on it ; off the north and south sides and parallel with the coast of the main island, are some smaller islands or rocks ; there is a depth of 6 and 7 fathoms within 2 cables of Tree island.

The north-west point of Saddle island (Harry head) is a high bluff, covered with trees, and there is deep water close to it ; about half a mile N.N.W. from Harry head is a small, round, wooded island, known as Spiteful rock (80 feet high), to the south-west of which there is a sandbank with about $1\frac{1}{2}$ fathoms on it at low water ; this bank, formed during the last 20 years, is about $1\frac{1}{2}$ miles long and very narrow. Between the above mentioned bank and Spiteful rock is a channel, with a depth of 3 fathoms, running close along the island, and between the sandbank and Saddle island there are depths of 5, 6, and 7 fathoms. The sandbank is steep-to on the south-east side, having 5 and 6 fathoms close to. To the N.N.E. and E.N.E. from Spiteful rock are also large sandbanks. Between Saddle island and Spiteful rock depths of 6 and 7 fathoms are obtained by keeping close to Saddle island, about a ship's length off the north-west point.

The north side of Saddle island is low and covered with jungle, and there is deep water (5 and 6 fathoms) along it. The north-east point is also low, and about East from it lie some small, low, rocky islands only a few feet above high water ; there is deep water close to the north point of them.

* The boundary between Burma and Siam is considered to run through Mostyn, Saddle, and Delisle islands ; these islands and the adjacent waters are not surveyed.

Delisle Island (Goh Piam) is large and high, about 4 miles long and 2 miles broad; along its west coast lies a reef of rocks close to the shore, and there is 8 to 10 fathoms water within one mile of them. About three-quarters of a mile S.W. by W. from their south point, is a rock about 3 feet above low water, spring tides, with 8 and 9 fathoms close to it. Between the east coast of this island and the mainland are large sand banks, but there is a channel along the Goh Piam side. On the north-east side of the island there is good anchorage in 5 and 6 fathoms water sheltered from the south-west monsoon. To the north of the island, between it and Saddle island, there are 5, 6, and 7 fathoms water, but there is a sandbank about 4 cables from the north point of Goh Piam, on which the depth is about 2 fathoms at low water.

DIRECTIONS from the northward.*—About 3 miles to the westward of Victoria point, lies a group of islands, the largest of which, named Long island, is about 2 miles in length, high and wooded; close to the south-east point of Long island is a round, wooded island named South island, and to the north-west, is North island, of about the same height.

Approaching from the northward do not shoal to less than 7 or 8 fathoms towards the flat off the Siam coast, until the open sea is visible between Hastings island on the one side and the islands of St. Luke and St. Matthew on the other, when the vessel will be about 10 miles south-west from Long island. Then haul round to the south-east until the west point of Long island is just open of North island, when steer straight for them on a north-east course. If beating in, tack when the opening is well closed, taking care to avoid a patch of broken ground with about 2 fathoms on it at low water, lying about 2 miles S.S.W. from the west point of Long island; in this channel are depths of 4, 5, and 6 fathoms at low water. When South island bears East, steer straight for its south point, passing about a cable from it in order to avoid two patches of rocks, awash at half-tide, lying about 3 or 4 cables to the southward of South island.

When past South island, there are no dangers except those visible, and the water is deep. Vessels attempting this passage, should, if Long and North islands are not plainly visible, bring the north point of Saddle island to bear E. $\frac{1}{2}$ N., and the highest peak on St. Matthew island N.W. by W. $\frac{1}{2}$ W., and then steer N.E.; this course will lead in between the large sand bank (extending, in a S.S.W. direction for about 18 miles from the mainland 14 miles to the northward of Victoria point) and the before-mentioned sandbank on which Spiteful rock stands. When Long island is seen, it should, as previously directed, be brought open of North island.

* See also page 338, if making the inside passage between Mergui and Pakchan.

Another route is to run in about E. $\frac{1}{2}$ N. towards Boundary island, keeping the sloping south extreme of that island in line with a small round island eastward of it. On this course there is not less than 5 fathoms. When Victoria point is seen, steer for it, keeping it in line with the north-west point of Victoria island and crossing the flat in not less than 3 fathoms at low water. When within a quarter of a mile of Victoria island, haul to the northward, and proceed as above directed.

Bound outwards, by steering about W.S.W., and keeping the islet off the north-west point of Victoria island in line with Victoria point, the rocks south of South island will be avoided, and this course after crossing the flat, will lead out to sea in 4 to 6 fathoms of water. In all the channels the flood stream sets to the north, the ebb to the south, at the rate of 2 to 3 miles an hour.

From the southward.—Between Victoria island, Victoria point, and Goh Phi is deep water, from 7 to 12 fathoms, but thence the passage out to sea runs between islands, sandbanks, and rocks, filling up the space around the mouth of Pakchan river to a distance of about 13 miles. The best passage for steamers coming from the south is, after passing west of Delisle island, to steer up towards Saddle island, passing about 2 to 3 cables from Tree island and then in between Saddle island and Spiteful rock, keeping close to Harry head (the north-west point of Saddle island), but caution is necessary, as the shoal bank on which Spiteful rock stands is unexamined. Keeping Spiteful rock right astern, steer on an easterly course for Stainer rock (a small rocky island lying about east from Harry head); on this course the depths are 5 and 6 fathoms, and the banks to the southward of Mostyn island will be avoided.

Steer to pass about one cable to the northward of Stainer rock and then haul up towards Dyke and Festing islands, care being taken to avoid the rock at the extremity of a spit extending eastward of Mostyn island; thence pass about 2 cables from Dyke island in 5 fathoms of water; on this course the depth is 4 and 5 fathoms. After passing Dyke island the course is about N. by E., passing two small islands (the northern of which is named Round island) to the south of Victoria island, about one cable off; haul in then towards Victoria island and keep from 2 to 3 cables off it to clear the large sandbank which extends from the mainland south of Renong river.

When the north-east point of Victoria island bears west, a course can be steered straight for Pakchan river; if bound for Renong, bring Goh Phi to bear East, and then steer in towards the south point of that island, and anchor in 4 fathoms water, with Goh Phi bearing about N.E. by N. distant 2 cables.

Caution.—Steam vessels using this passage should keep a good speed in passing between Saddle island and Spiteful rock, as the tides here are sometimes strong; keep close to the north-west point of Saddle island, as both flood and ebb streams set over towards Spiteful rock and the sandbank to the south-west of it. The tidal stream has in this passage been known to run at spring tides, at the rate of 4 and 5 knots an hour. When past this entrance there is smooth water and good shelter from the south-west monsoon; sailing ships should, however, not attempt this passage. Steam vessels coming from the north should keep well to the southward before they steer for Saddle island, in order to avoid the sandbank extending from Spiteful rock.

Tides.—It is high water full and change at the anchorage off Goh Phi at 10h. 40m.; springs rise between 11 and 12 feet, and neaps 8 to 9 feet. The ebb tide rushing out of Pakchan river splits at the north-east point of Victoria island, one part setting to the west and the other to the south; both streams being rapid at spring tides. Tidal influence is felt in the dry season for 10 miles above Krà, at which place the spring rise is 8 feet.

THE COAST.—From the mouth of Pakchan river the coast of the mainland takes a S. by W. direction for about 44 miles, to the mouth of Takuapah or Kopah inlet; it is unexamined and should not be approached without a pilot. The coast is mostly low, densely wooded, and intersected by a great number of rivers and creeks. Inland is a range of mountains about 10 miles from the coast, the highest and most remarkable peak of which is Kau Da Chung Dung; it presents an almost perpendicular appearance. Off the coast are a number of large and smaller islands, mostly surrounded by reefs, and connected with the mainland by sand-banks.

Sugar Loaves.—About 11 miles S. by W. from Delisle island is a group of high, bold islands called the Sugar Loaves; the group consists of two large islands (Goh Jam Jai and Goh Jam Nai) and several smaller ones. Goh Jam Jai, the largest and highest, is the western island of the group, and there is 10 fathoms of water 3 miles westward of it.

About 2 miles south of this group is Goh Lan (or Metcalf island), also a high and wooded island; north-west from it, is a small island and a rock. About 3 miles north-east from the group is Goh Kang Kan, a high and wooded island, surrounded by rocks.

Hayes Island (Goh Khai Jai) is a round, high, wooded island about 10 miles south from the Sugar Loaves, and about 4 miles north from Goh Rah; north-west from it is a smaller rocky island (Umbrella island, Goh Khai Nai), so called on account of having a single tree on its highest point looking somewhat like an umbrella. Both these island are surrounded by

large sandbanks and rocks, and at low-water the sea breaks in several places to the westward of them. Vessels coming from Takuapah bound north should, when in the mouth of the inlet or off the north point of Goh Rah, steer W.N.W. for about 5 miles, when they can haul up to the northward, giving Hayes island a berth of about 5 miles.

Goh Rah is a high, thickly wooded island, with deep water along its western coast; it lies north of Goh Pra Tang, and extends in a northerly direction for about 5 miles.

TAKUAPAH (or KOPAH) INLET is a large river, in the province of Muang Takuapah belonging to Siam; the principal entrance is between Goh Rah and the mainland, about 4 miles south of Hayes island. From the mainland and Hayes island, large sandbanks extend, and vessels entering the river should therefore pass about half a mile from the north point of Goh Rah, where there is a depth of 5 or 6 fathoms. When the north point is passed, steer S.E. by E. along the north-east coast of Goh Rah in 4 and 5 fathoms water. From the north-east point of Goh Rah steer S. by. W $\frac{1}{2}$ W., keeping close along the Goh Rah side, and passing about 2 cables distant from a projecting bluff, on the east side of Goh Rah, in order to avoid a sandspit which extends from the mainland to within 3 cables off this bluff; on this course are depths of 4 and 5 fathoms.

When past the bluff, steer South for about one mile, and haul gradually (keeping on the Goh Pra Tang side) to S.S.E. $\frac{3}{4}$ E., and when on that course keep in the middle of the river, in 5 and 6 fathoms. On approaching the end of this reach, a large group of fishing stakes will be seen on the mainland side, and to the south of two small islands, which when sighted steer straight for; this course will clear a sandbank extending from the east point of Goh Pra Tang, and a smaller bank, with 14 feet on it at low-water, lying 3 cables north-east from it. When close to the fishing stakes, steer S.W. $\frac{1}{2}$ S., keeping on the mainland side, and passing on the starboard side or eastward of a white buoy which marks a patch of broken ground, on which in some places is a depth of only 9 feet at low water springs; on this course are depths of 4 and 5 fathoms.

After passing the white buoy, steer straight for Koh Kruen, a high hill thickly wooded, situated on the south side of Pak Kruen; on this course are depths of 4 and 5 fathoms. When the range of small hills is passed, a small rocky island will be seen almost right ahead, and another round, thickly wooded island on the starboard bow; with the latter island bearing south and the former east, a vessel may anchor in 3 fathoms at low water spring tides. Care must be taken not to anchor too far north of this position, as near the anchorage are two groups of rocks which are only visible at half tide.

Smaller vessels may go farther up the river by steering for the north point of the small rocky island (above mentioned), and then passing within a ship's length from it; here is a depth of $2\frac{1}{2}$ fathoms at low water spring tides, but the water appears to be getting shallower every year. After passing the island, steer to the south-east, keeping in the middle of the river for about a mile, and then anchor in 2 fathoms at low water close to a small creek, through which boats, instead of following the main river, can go up to Takuapah town, thereby saving considerable time. This creek is, very shallow, and at low water passable only for small boats. From this upper anchorage the main river runs in a S.E. direction for about 5 miles, then turns off to S.S.W. for about 4 miles, and then in a southerly direction for about 5 or 6 miles. Above the upper anchorage, however, the river is shallow, and has at low water only from 4 to 5 feet in some places in the deepest part of the channel.

The town of Takuapah, where the Rajah resides, is situated (in lat. $8^{\circ} 48' N.$) about 15 miles from the upper anchorage on the left side of the river, and is surrounded by tin mines and large plantations; the inhabitants are mostly Chinese. The only export is tin; next to Puket it is the largest tin-exporting place on the coast of Siam. The houses are mostly of bamboo and atap, but there are some brick buildings, and a good market, where provisions and vegetables may be procured. There is fortnightly mail connexion with Rangoon *viâ* the coast, and Penang *viâ* Puket. Besides Takuapah, there are several mining villages along the banks of the river, and the land about the town and to the northward is undulating, mountainous, and can be seen from a long distance seaward. Pia Sima, the highest mountain, about 10 miles to the eastward of Goh Rah, culminates in three peaks of nearly equal elevation, and is upwards of 3,500 feet above the sea.

Tides.—At the anchorage 15 miles below Takuapah it is high water at full, and change at 10h. 40m.; springs rise about 10 feet, neaps 7 to 8 feet. The tides in the river are, on account of the many outlets to sea, very irregular; the stream seldom runs at the rate of more than 4 miles an hour in the upper part, and from 2 to 3 in the lower part of the river.

Along this coast from Goh Rah to the south point of Junkseylon, the flood stream sets to the north, the ebb to the south, at the rate of from one to 2 miles an hour, within 10 or 12 miles of the coast; farther out it is weaker and more dependent on the winds.

Pak Kruen, the middle entrance to Takuapah inlet, is about 15 miles south of the Kopah entrance, and has on each side, a large sand-bank partly dry at half tide, and extending one to $1\frac{1}{2}$ miles seaward, on both sides of the channel. In the channel, which takes a W.S.W. direction and has the deepest water along the north bank, between the

sandbanks, are depths of 5, 6, and 7 fathoms. Outside the channel is a large sandy flat on which is a depth of $2\frac{1}{2}$ fathoms at low-water spring tides; this bar seems to have the same depths all over and without any deeper channel across it. In the north-east monsoon, when bound out from Takuapah inlet, this channel is safe and easy, and when between the sandbanks a W.S.W. course will lead straight to sea.

Entering the river from seaward this channel is more difficult (as the entrance between the sandbanks cannot then be seen), and it should not be attempted without local knowledge. In the south-west monsoon there is generally a heavy swell on the bar, and the northern entrance is then much to be preferred. The sandbanks here are not shifting, and the passage remains the same. When the sandbanks are passed, a broad safe channel with 6 and 7 fathoms water, leads into Takuapah river.

Lem Goh Pra Tang.—On the north side of the entrance to Pak Kruen is the south-west point of Goh Pra Tang, a large, low, thickly wooded island extending in a north and south direction about 9 miles; it is separated from Goh Rah to the northward by Pak Tjik, a narrow entrance filled up by sandbanks and rocks, and only passable for boats. The west coast of Goh Pra Tang is low and sandy, with 7 or 8 fathoms water about one mile off it.

Goh Gah is a small sandy island about one mile from the shore and 7 miles south of Pak Kruen; on the island there are a few small trees, and it is surrounded by extensive sandbanks, which are fronted by a circle of rocks lying in from 2 to 5 fathoms water, partly visible at low water. To the south-west, outside of this circle are some rocks, but the other sides appear clear of dangers; shoal water (5 and 6 fathoms) extends for some distance to the westward of the rocks, and vessels should not approach this island nearer than $\frac{1}{2}$ 4 miles. Between the island and the mainland are sandbanks with only a few feet of water on them; 4 to 5 miles west from the island are depths of 10 and 12 fathoms, but shoal casts of only 5 and 6 fathoms water have been reported in this direction.

Pak Koh (Bangri of Horsburgh), about 4 miles S.S.E. from Goh Gah, is the most southern of the three entrances to Takuapah inlet; it is narrow and shallow, with exception of the western entrance, where there is a passage between sandbanks, with from $2\frac{1}{2}$ to 3 fathoms at low water for about 2 miles; the course in is E.S.E. between the sandbanks or with the low casuarina tree point, in line with the first south notch of River hill. Inside the bar the water deepens to 5 and 6 fathoms. These sandbanks are said not to shift in the monsoons (as they do in Papra), and the channel to be the same now as it has been for many years. The land around is low and richly wooded, but there are numerous small creeks, and at high water a large part of the country around is flooded, making it little else than

a mangrove swamp. During the fine season this entrance may be made use of with advantage, but in the south-west monsoon the northern entrance is the only safe one.

The flood and ebb stream in the Pak Koh entrance is regular, and runs from 2 to 3 knots an hour; it is high water, full and change, at 10h. 40m.

Lem Krang Nai is a small low point about 3 miles S.S.W. from Pak Koh; from this point reefs and broken ground extend about a mile off.

Lem Krang Jai, 5 miles S.S.W. from Lem Krang Nai is a low, sandy point covered with high trees; from the point a large reef and broken ground extend for a distance of about 2 miles in a westerly direction; some of the rocks are visible at low water. This point should not be approached nearer than 3 or 4 miles, and the water not shoaled to less than 10 fathoms; indeed the whole coast from Lem Krang Jai to Lem Lajan should not be approached too closely, as the ground is rocky and uneven. The coast between Lem Lajan and Klong Kokah is high, with hills close to the sea, but from Klong Kokah to Lem Krang Jai it is low and wooded.

KLONG BAGATAE or Tang Pran is a large river to the eastward of Lem Tham Tjob; it is broad and deep in the entrance for about 3 miles, there being 4, 5, and 6 fathoms at that distance; higher up, the river is shallow and full of sandbanks. About 3 miles up the river is a rock above water, above which vessels drawing more than 8 to 9 feet cannot ascend.

Ban Tapmo is a small village in the mouth of Klong Lam Rin (first creek on eastern bank), but the large village of Ban Bagatae is situated some miles farther up this branch of the Bagatae river. Fresh provisions and water may be had here. Numerous creeks and small rivers fall into Klong Bagatae, and several villages are situated on the sides of the river. There are important tin mines close to this river, but they are being worked under disadvantages, as, in consequence of no steamers calling here, the tin has to be carried on elephants, over high hills, to the Rajah's residence in Takuatung.

The anchorage inside the river is good and well sheltered from all winds; the bottom, mud.

Directions.—The river may be safely entered by steering East, for Lem Lajan, a high hilly point about $1\frac{1}{2}$ miles north-east from the north point of Lem Tham Tjob; when the river is seen opening fairly, steer straight down it, keeping to the Lem Tham Tjob side, where the deepest water is, and inside the north point of which there is no danger. When off Ban Tapmo, vessels can anchor in 3, 4, or 5 fathoms, the deeper water being towards the Lem Tham Tjob side. Between Lem Lajan and Lem Tapmo is a sandbank fronted with rocks, mostly visible at low water.

To the southward of Lem Lajan the mainland side is low and densely wooded. The deepest channel into Klong Bagatae appears to be close to the rocks extending from the north point of Lem Tham Tjob.

Klong Kokah is a river about 4 miles north of Lem Lajan, some distance up which stands the village of the same name; there are important tin mines in the vicinity. In the mouth of the river are large sandbanks extending some distance out. About one mile north from Kokah is another smaller river.

LEM THAM TJOB (Cape Dolphin), 500 feet high, bold, and steep-to on the western side, having 10 fathoms near the shore, is the only high point close to the sea between Goh Rah (at the mouth of Takuapah inlet) and Lem Kho Phra Chao on Junkseylon. To the northward, Lem Tham Tjob forms a long sloping point, on the extreme north of which are two small hills: from the point, rocky ground extends in a northerly direction for about 5 cables, most of the rocks being visible at low water. The high land of this cape forms the west or left bank of the river Bagatae.

Hin Lompuk is a group of rocks about 6 feet high, lying about one mile north-west from Bataluk, about half a mile off the coast; there are 5, 6, and 7 fathoms close to them; north-east from them are two smaller rocks close to shore.

Ban Tasai is a village about 4 miles north from Bataluk, where Klong Tasai turns to the eastward. Fresh water is plentiful here (Klong Tasai being fresh). Between Ban Tasai and Lem Tham Tjob are a few villages. The coast from Lem Tham Tjob to Lem Pak Phra (Hin Lompuk excepted) appears clear, and with water shoaling gradually to depths of 6, 7, and 8 fathoms about half a mile off the coast.

Bataluk is an inlet into which three small rivers debouch, namely, Klong Gva from the south, Klong Kli from the east, and Klong Tasai from the north; the latter is the largest, and runs parallel with the coast (from which it is only separated by a sandbank) for about 4 miles, and then turns off to the eastward. At the entrance to Bataluk are sandbanks on which is shallow water, but they do not extend far out. At Ban Bang Kli, a village at the mouth of Klong Kli, water and poultry may be procured.

The coast of the Siamese province of Takuatung, from Lem Tham Tjob, trends S. by E. as far as Lem Pak Pra at the entrance to Papra or Pak Phra strait, and is low, sandy, and densely covered with trees. Lem Pak Phra, the south-west point of the continent, is rendered remarkable by a group of high trees. About 4 miles south of Bataluk inlet is a small hill (Koh Pilai) close to the water's edge, which may be useful as a mark for making Papra strait, as it is the only hill on the coast between Lem Tham Tjob and Lem Kho Phra Chao in Junkseylon. The

coast between should not be approached nearer than 3 miles, as it has not been closely examined.

SALANG or JUNKSEYLON ISLAND,* occupied by the Siamese of Ligor, is separated from the Malay peninsula by Papra (or Pak-Phra) strait, and extends between lat. $8^{\circ} 10'$ N. and $7^{\circ} 46'$ N.; it is about 24 miles long, 9 miles broad, and is divided into two Rajahship of about equal size; the northern being called Thalang, and the southern Puket. The population of Junkseylon, composed of Malays, Chinese, and Siamese (in 1879), was about 32,500. The principal towns are Bandon, Puket, Katha, and Tharua the old capital. The north coast of Papra strait is under the Rajah of Takuatung.

Junkseylon is rich in tin mines, which appear to have been worked by Chinese miners for centuries back. The mines employed (in 1872) nearly 35,000 Chinese, but since then there has been a steady decrease in the number, owing to the depreciation in the value of the metal. The mining is worked in the primitive manner the Chinese adopt, the result being that during the dry season all operations are stopped for three months, for want of water.

The West coast trends nearly north and south, and has several large bays, with deep water, but none affording any protection against the south-west monsoon. The northern half of this coast is low wooded land, with the exception of one piece of high land, at 8 miles from the north point of the island. The southern half is a range of mountains 1,000 to 1,750 feet high, thickly wooded, sloping gradually to the northward and southward, and visible at a distance of 30 miles. This side of the island is steep-to, with 10 and 12 fathoms close to the shore. Off the west coast are two small islands Goh Gata (Gavai), one of which is 50 feet high, the other low; they lie close together S.W. by W. $\frac{1}{2}$ W. one mile from Lem Son, and have deep water around them.

Bandon river lies just south of Lem Son; on it, is the town of Bandon, which contains about 100 houses, and the residence of the Rajah of Thalang.

PAPRA or Pak-Phra strait, separates Junkseylon from the Malay peninsula, and is about 14 miles long. The natives are very superstitious about this strait, which they have named Pak-Phra or Lord's mouth; the passage is much used by junks. The land on both sides is

* See Admiralty charts :—Bay of Bengal, No. 70; Sayer islands and adjacent coast, including Junkseylon, No. 842; Bassein river to Pulo Penang, No. 830; Remarks (amended) of Commander A. de Richelieu, Siamese gunboat *Coronation*, 1876. Lem (Siamese), means point or cape; and Goh, an island. Information also published in China Sea Directory, vol. I.

mostly low and wooded, but the capes or lems are high. Along both shores of the strait are several villages where provisions and water may be obtained.

Bar.—Directions.—Outside the western entrance are large sand-banks, which are continually shifting; it is not prudent to enter without a pilot. Close to the entrance, which is about half a mile broad, there is a reef of rocks lying along the mainland and only visible at low water; but the reef does not extend far.

In the south-west monsoon the sea breaks entirely across the channel, but in the north-east monsoon the bar is generally smooth. In January 1877, the channel was close to the northern shore; and then straight to seaward in a W.S.W. direction, and the depth, which was 7 feet in 1875, was then 3 fathoms. Inside the bar there is good anchorage in 5 or 6 fathoms. From the west entrance of Papra strait to Lem Khun, there is a good channel with 4, 5, and 6 fathoms at low water.

The narrowest part of Papra strait is between two points, Lem Hin on the continent and Lem Khun on Junkseylon, $4\frac{1}{2}$ miles from the west entrance, to the eastward of which, there is a sand-bank dry at low water, and to the southward of this bank the depths are 9 feet at low water, whilst 4 and 5 fathoms are to be found on the north, west, and east sides of the bank. Another large sand-bank extends from the west side of Lem Asam, between which bank and the aforesaid bank, lies the channel.

Between the dry sand-bank situated in the middle of the strait and Goh Galah, a small white rocky island situated $1\frac{1}{2}$ miles to the south-east of Lem Khun, there is a broad channel with 4 and 5 fathoms water. Goh Janak is a small island lying a quarter of a mile to the south-west of Goh Galah. To the south-west of Goh Janak there are extensive sand-banks dry at low water, and to the south is Tamaprau river, on the banks of which, at 2 miles from the mouth, the town of the same name stands, and again, $1\frac{1}{2}$ miles further, another larger town, Muang Mai; but boats cannot go beyond Tamaprau. To the eastward of Goh Janak and Goh Galah there is good anchorage in 4 or 5 fathoms.

Directions.—Pass the north-east side of Goh Galah 2 cables distant and then steer S.E. to pass Lem Sai (on Junkseylon) one or $1\frac{1}{2}$ cables distant; in this part there are soundings of 4 and 5 fathoms. Thence steer E. by S. to pass about 2 cables north of Goh Rangam Jai or Passage island of old English navigators, a round island, like all the rest in this locality, covered with trees; between these two places the channel, which is formed between the fringing sandbanks, is little more than a cable wide, has 12 feet at low-water springs, and is composed of soft mud. From Passage island steer East to pass about 3 or 4 cables southward of Goh Rangam Noi, the water gradually deepening as the latter is approached, pass Lam Lem or cape Three points (the north-east point of Junkseylon) at 3 or 4 cables

distant, and with 7 fathoms water. Thence E. $\frac{1}{2}$ N. to pass 5 cables south of Goh Leng, and 3 cables north of Goh Thanan or Pulo Chupa, a small round island one mile east of Lam Lem. Pass one mile eastward of Goh Thanan, and then, if bound to Tharua harbour, steer between Goh Ret and Goh Naka Jai in a channel having 6 fathoms water.

Tides.—The tides in Papra strait are very irregular. At the bar the times of high and low water seem to correspond nearly with those at Puket. In the strait, the flood stream sets in from both sides at the same time and meets at the sand bank of Lem Khun. The ebb stream also runs out of both entrances to the strait at the same time. In the middle of the strait there is hardly any tidal stream, but the water rises and falls from 6 to 8 feet. At the west entrance of the strait the tidal stream sometimes runs at the rate of 6 knots; at the east entrance it generally attains only half that velocity.

The South coast forms a large bay (Khelong bay) with shallow water, the south-west point of which is called Lem Voalan. At nearly three-quarters of a mile to the southward of this point lies Goh Keo-jai or Pagoda island, on the north-west point of which there are two white pagodas. Between this island and Voalan point there is a safe passage having 8 to 10 fathoms water. To the southward of Goh Keo-jai stands another island, Goh Keo-noi, smaller than the former, but of equal height and covered with trees. Besides these two islands there are five others along the south coast of Junkseylon, all high and wooded, with depths of 5 to 10 fathoms round them, except along the north side of Goh Khalom. The inner passage round the south coast is deep; it runs between Lem Voalan and Goh Keo-jai, to the southward of Goh Aa and Goh Khalom, and northward of Goh Hee and Goh Bon.

Khelong bay.—During the south-west monsoon the best anchorage is in 5 fathoms, at about 3 cables northward of Goh Aa. In the north part of Khelong bay are two small rivers Reusong and Mudong, both leading to large villages where water and provisions may be had in abundance, at reasonable rates.

In the inner passage the flood streams set to the eastward, and the ebb to the westward, at the rate of from one to 3 miles an hour.

The East coast trends north and south, is fronted with numerous islands, and has two harbours, namely, Puket or Tonkah and Tharua. Between the east coast and Pulo Panjang there is a broad channel in which the flood stream sets to the northward and the ebb stream to the southward, at the rate of 2 to 3 knots an hour.

PUKET HARBOUR (generally known as Tonkah), lies northward of Khelong bay. Puket is the principal place in Junkseylon, and the residence of the Rajah, it is the only port frequented by coasting

steam vessels. The sole export is tin, of which about 6,000 tons leave Puket every year.*

Pulo Siri (Cirie), an island only separated from the shore by a narrow creek, which at low water is impassable even for boats, forms the north-east extreme of Puket harbour; its south-east point is named Lem Atpha.

Town.—The town of Puket lies about one mile up a small creek. At high water, boats can ascend to the town; but at low water they can only reach the stone pier by the harbour master's office, from which a road leads to the town. The buildings in Puket are mostly wooden houses with thatched roofs, but there are a few brick buildings. The principal are, the Government house, the residence of the Siamese Royal Commissioner, a stamp office for tin, the barracks and Commandant's house, and several tin-smelting houses.

Mails.—There is a weekly mail service between Puket and Penang, and a fortnightly mail to Rangoon and intermediate ports.

Supplies.—Fresh beef is difficult to procure, but poultry and vegetables are plentiful, and can be obtained at reasonable prices. Water (not very good) is brought alongside at 4 dollars per 1,000 gallons. Coal cannot be procured, but firewood can be purchased at 8 dollars per 1,000 pieces. Good fresh water can be taken from two wells, one at Goh Tapau-jai (Pulo Kapal Besar), the other on the north side of Nambo point, the point to the north-west of that island.

Six miles west of Puket is the town of Kathu, containing about 8,000 inhabitants, principally Chinese miners. A good road extends between Puket and Kathu.

Anchorage.—The harbour is divided into two anchorages by a sandy flat, over which there is only from 6 to 9 feet at low-water spring tides, therefore, only small vessels can go into the inner harbour. Large vessels should anchor in from 4 to 5 fathoms, about 2 or 3 cables southward of the black buoy which marks the south side of the sandy flat. A red buoy marks the north side of the flat, and small vessels may anchor in $2\frac{1}{2}$ fathoms at low water about 3 cables to the northward of this buoy.

Tides.—It is high water, full and change, in Puket harbour at 10h. 10m., springs rise 9 feet, neaps 7 feet; during the south-west monsoon the day tides are higher than the night tides. In the north-east monsoon the night tides and the day tides are equal. Very little tidal stream is felt in the harbour.

DIRECTIONS.—Lem Phan-Va, the south-east point of Junkseylon is steep-to; a shoal on which stands a group of rocks awash at high-water

* See Admiralty plan of Puket harbour, No. 843; scale, $m = 2$ inches.

extends from the point nearly one mile to the south-west. Vessels proceeding to Puket, when off this point, should steer north-eastward until Tonkah hill is seen bearing N.N.W. between Tapaunoi and Tapau-jai islands, when it should be steered for, passing between these islands in a depth of 4 fathoms. After passing between them, steer N. by W. if intending to anchor in the outer harbour. If bound to the inner harbour steer to pass close to the westward of the black buoy, and to the eastward of the red buoy.

Vessels from the eastward may enter the harbour by passing to the northward of Pulo Kapal Kechil, and to the north of a red buoy which marks a coral reef extending one cable from the north end of the island. Between Pulo Kapal Kechil and Lem Atpha (the north-east point of the harbour), there is a sandbank having only 6 or 7 feet at low-water spring tides. From the south side of Pulo Kapal Besar, a rocky reef, with a small islet and sandbanks, extends to a distance of one mile southward.

The bottom, at both inner and outer anchorages, is mud. The harbour is open to east, and south-east winds, during the prevalence of which there is a little swell.

WINDS AND WEATHER.—*January.*—Steady north-east monsoon; generally more to the E.N.E. and sometimes East. The wind is often stronger in the evening and night than in the daytime. Temperature between 60° and 80°. No rain.

February.—Steady north-east monsoon the first half of the month with no rain, and generally blowing fresh. In the latter part of the month the north-east monsoon becomes weaker, and is squally every three or four days, generally in the evening, and from the northward. In this month fresh water is very scarce, there is also much fever and other sickness amongst the natives.

March.—North-east monsoon very weak, generally from North, and sometimes N.W. with occasional squalls from the N.E. Temperature between 75° and 90°. Great scarcity of water and much sickness on shore.

April.—Change of monsoon, winds from West to North; heavy squalls from the north-eastward generally occur with high water in the afternoon or evening. The night tides are very low. There is much sickness.

May.—The burst of the south-west monsoon occurs in the first week of May, after which the wind seldom blows from the east quarter. The heavy rains now commence, and squalls are frequent. On the west shore of Junkseylon the swell is heavy, but Puket harbour is well sheltered.

June.—South-west monsoon fairly set in, with heavy, squalls from the S.W. and N.W. When rainy weather sets in it usually lasts for five days, after that there is generally fine weather (without rain) for about a week;

and sometimes for a fortnight. Temperature between 60° and 80°. Day tides higher than night tides.

July.—South-west monsoon, with squalls and heavy showers ; generally the weather is rainy for five days and then fine again for five days. When the wind is due S.W., there is rain ; when West and N.W., fine weather.

August.—Strong south-west monsoon the entire month, with squalls and heavy rain, much the same as July, but in August the rain sometimes continues for ten and fifteen days, and is usually followed by the same period of fine weather. Heaviest squalls generally at night-time. Mean temperature 82°. This is the hottest month, and the greatest rainfall occurs, the average number of rainy days being from eighteen to twenty.

September.—Strong south-west monsoon, but the wind more from westward. Fewer squalls, but heavier and longer showers of rain than in August. Mean temperature 80°. Rainy days about eighteen. Fine weather generally lasts but one or two days at a time.

October.—During the first half of month south-west monsoon is steady ; towards end of the month the wind is very unsteady ; Westerly and S.W. still prevailing. Showers not so heavy as in September. Rainy days about fourteen. Weather cloudy. Mean temperature 80°. Day tides still higher than night tides.

November.—Weather variable. West and S.W. winds still prevailing, but often veering to the northward and eastward ; heavy squalls from all quarters, but heaviest from S.W. Rainy days about fourteen. Weather very cloudy the whole month, generally three or four days fine at a time.

December.—North-east monsoon setting in strong and with heavy squalls from N.E., wind generally to the eastward of N.E. ; sometimes heavy squalls from the north-west accompanied with lightning. Average number of rainy days six or eight. Mean temperature 80°. Towards the end of this month mostly clear weather. Day tides and night tides of equal height.

Goh Khai Nok is a small, low, sandy island, lying in the channel between Pulo Panjang and Junkseylon, about 5 miles E.N.E. from Lem Atpha, with a bluff on the south side, covered with trees ; it is surrounded with rocks to a distance of about three-quarters of a mile, of which two patches are visible, the one north-westward, the other south-eastward of the island.

Goh Khai Noi is smaller and lower than Khai Nok, from which it is separated by a channel, $2\frac{1}{4}$ miles broad, with depths of 10 and 12 fathoms. This island is surrounded by rocks, which do not, however, extend far out.

Goh Sob (Sister's) are two small, high perpendicular rocks, about $3\frac{1}{2}$ miles N. by E. from Goh Lipe (a conical rock more than 100 feet high), and about one mile off the coast of Goh Jao Jai; there is deep water all around them.

Tharua harbour is the next large bay to the north of Puket. The town of Tharua, situated $1\frac{1}{2}$ miles up a small river, was formerly the residence of the Rajah of Puket, but in 1859 he removed to Puket; previous to 1796 (when Tharua was demolished by the Burmese) it was a town of considerable importance. At that time there was a large Portuguese settlement here, and the harbour was frequented by numbers of European vessels; there is, however, no trade at Tharua. The ruins of a fine market street, composed of large brick buildings, and the spacious houses belonging to the Europeans who once resided here are still to be seen; an evidence of its former importance.

There are two entrances to the harbour, the better one being to the northward of Alang Noi; the other to the southward of Alang Jai, and passing to the northward of Goh Mali, and Goh Cap.

Directions.—Entering the bay steer W. by S. to pass about half a mile northward of Alang Noi in 8 fathoms, after passing which, the water will shoal gradually towards the anchorage, where there is a depth of 3 fathoms, mud bottom, with Alang Noi bearing E. by N., and the middle of Goh Maprau about South. There appears to be a shoal about half a mile westward of Alang Jai, and vessels should not attempt to pass between Maprau and that island, as the channel is foul. Farther northward are three other islands, Goh Peh, Goh Naka Noi, and Goh Naka Jai; patches of rocks extend for $1\frac{1}{2}$ miles north-westward of Naka Noi. Between these last three islands and Junkseylon is a good channel, with from 4 to 5 fathoms water.

Klang Bangkrong, westward of Goh Naka Noi, is a river leading to the old residence of the Rajah of Thalang, who lives now at Bandon, up a river of the same name on the west coast of Junkseylon.

PULO RAJAH (Saya).—This island, situated 5 miles N. by E. $\frac{3}{4}$ E. from North Brother island, rises to a height of 1,064 feet in the south-western part, while the north-east side is low.*

Gulnare cove, at the north-west point, is about half a mile deep by a quarter of a mile wide, having 9 fathoms sandy bottom, in the centre. There is another small inlet on the north side of Pulo Rajah, where a stream empties itself.

* Information relating to Pulo Rajah and the Brothers islands from Commander the Hon. F. C. P. Vereker, H.M.S. *Magpie*, 1883-4.

Overfalls.—There are heavy overfalls between Pulo Rajah and Brothers islands.

BROTHERS ISLANDS, situated about 15 miles southward of Junkseylon, are densely wooded, steep-to, and nearly connected by a reef. The northern island, 517 feet high, has a detached rock lying $3\frac{1}{2}$ cables off the north extreme. The southern island, 239 feet high, is of nearly a uniform height on the summit, and a reef extends about one cable from the south point.

CURRENTS.—Northward of Junkseylon, during the north-east monsoon, the current sets S.S.E., and during the south-west monsoon to N.N.W.

Southward of Junkseylon during the north-east monsoon the current sets N.W., and during the south-west monsoon it sets S.E., but if the wind has been strong from West or W.N.W., the current will run nearly East, southward of the Brothers islands.

APPENDIX.

The following information relative to the Irrawaddy river, is compiled from remarks by Commander A. Carpenter, R.N., in charge of Indian Marine Survey, September 1886, and has been received since this work has been in type.

IRRAWADDY RIVER.

Tributaries.—The principal affluents of the Irrawaddy river are the Mogaung, Taeping, Shewelé, or Swali, Maina, Karin, Madra, Myitnge, Mu, Chindwin, Yan and Yen rivers; of these the Chindwin is by far the largest, and although not as deep as the Irrawaddy, drains a large area of country, and on meeting the main stream in about lat. $21^{\circ} 30' N.$, doubles its volume.

There are three defiles through which the Irrawaddy river flows. The northern, above Bhamo town is only navigable by boats in the dry season.

The second defile, 15 miles to the southward of Bhamo and very picturesque, is 8 miles long and about 160 yards wide at its narrowest part, the greatest depth being 23 fathoms; hills about 900 feet high rise almost perpendicularly on either hand.

The third defile, 35 miles above Mandalay, through which the river flows quietly between two ranges of mountains trending North and South, is 29 miles long with an average depth of 4 fathoms and a quarter of a mile wide at its narrowest part.

From Thayetmyo to Minhla, a distance by river of about 46 miles, the river runs nearly due north for the first 25 miles (skirting the eastern face of a range of hills 1,200 feet high), when it is divided into two channels by Laungi island, wooded, $1\frac{1}{2}$ miles in length, with a sand bank projecting from its northern and north-western sides; the channel, narrow but deep, lies along the western or right bank; care is necessary on account of the eddies that form off two small hillocks opposite the west point of Laungi island. The eastern channel which leads past the town of Senbaungwai can only be used in the wet season. There is no town of importance in this reach, Mye-de 3 miles above Thayetmyo being deserted.

From Laungi island to Minhla the river bends considerably but there are no middle grounds and the course though crooked is an easy one, the

river flowing between hills from 100 to 300 feet high, half way between Laungi island and Minhla.

Taung-gwen island, $1\frac{1}{2}$ miles long with some ancient pagodas on it, lies in the centre of the river, the course is up the western channel.

Minhla is situated at an angle of the river on the western bank. Kola-kone fort occupies the heights opposite the town. There is good anchorage where the river opens out between Kola-kone fort and the town, except to the S.E. of the point on which the town is built, where a sand bank exists. Vessels secure if required, alongside the river bank close to a small square fort in the centre of the town; trade is considerable and is probably brought down the Yen river. The current runs strong off Minhla.

Yanan-yaung lies about 25 miles above Minhla. Two miles above the latter, the river opens out considerably and central low lying islets and sand banks make the channel intricate.

The Yen river joins the Irrawaddy on the left or eastern bank, 7 miles above Minhla, having off its mouth a large low island surrounded by sand banks, on the southern side of which, lies the channel.

Magwe, 15 miles above Minhla, on the eastern bank, is about 3 miles long, with several fine pagodas; Menbo town opposite is also conspicuous by its pagodas and high cliffs. In the dry season the deep channel crosses the river eight times or at every 4 miles. The hills lie well back in this reach except at Magwe and Ta-fau-zeik, an abrupt rocky point with cliffs 80 to 120 feet high and a pagoda on their summit; the channel passes close to this point, a sand bank extending towards Ta-fau-zeik point from the opposite bank, narrowing the channel considerably.

From Minhla to Yanan-yaung, the river trends about N. by W., and receives five tributaries, viz., on the eastern bank the Yen, the Karin 10 miles below, and the Pyin 1 mile above Yanan-yaung; and on the western bank, the Ma river immediately above Menbo and a smaller stream opposite Yanan-yaung. The current is stronger in this reach than in any other above Thayetmyo.

The low central islands and the flats on either bank are covered with elephant grass 8 to 10 feet high; most of these islands cover in August, the grass only showing above the water. Temporary villages are built on piles and the islands cultivated during the dry season.

From Yanan-yaung* to Pagan, a distance of 42 miles in the wet and 50 in the dry season, the river trends N.N.W. and North. The most important places in this reach are Kyabin near Semfyogun on the

* Yenun-gyaung means an odorous water rivulet. Renan is the term applied to the earth oil, and is pronounced Yenan.

west bank, and Pagan-nge and Silli-myo on the eastern bank, Pagan-nge lies opposite and below Kyabin. The channel crosses the river about every six miles, and the breadth between the main banks averages two miles; the greatest width of river is between Pagan-nge and Silli-myo, nearly four miles between the main banks. The bed of the river is filled with extensive flat islands that nearly cover in the freshets, and in the dry season the channel lies between the two large alluvial islands, the main banks only being recognised by the line of large trees showing on either hand; about 10 miles above Yanan-yaung and again above Palai-myo, low hills run close down to the river bank.

About 6 to 10 miles east of Silli-myo a solitary mountain named Poupa, rises abruptly, and is visible from Magwe up to Mingyin. Some of the bends of the channel in this reach are very sharp, turning almost straight across the river; it is advisable to keep the up stream side of the channel.

The Yan river entering this reach 13 miles below Pagan on the western bank, is the only one of importance. It disembogues through a range of hills faced with abrupt cliffs, but in the dry season the entrance is barred by sand banks. Six miles below Pagan the crossings are very crooked.

From Pagan to Mingyin, a distance of 30 miles in the wet and 40 in the dry season, the general trend of the river is about N.E. by E. and it seldom exceeds 3 miles in width between the main banks, which are low; a small range of hills lying 3 miles back from the bank south of Pagan, trends to the southward for 7 miles. Two conspicuous hills lie about 7 miles S.S.E. of Mingyin and are in line with each other when a vessel is two miles to the westward of the town.

Pagan city,* situated in an angle of the river in about lat. $21^{\circ} 10' N.$ long. $94^{\circ} 50' E.$, is a dead city of pagodas, and is said to have been a former Capital of Burma, deserted on account of the death of a queen. Both here and at Yanan-yaung the soil is very remarkable, showing a process of fossilization, the fields and river banks being covered with specimens of fossilized trees, &c.

Chindwin river, the largest tributary of the Irrawaddy, drains the country 90 miles to the westward of the right bank of that river, joining the main river 10 miles below Mingyin, some 6 miles above which town the Irrawaddy is connected with the Chindwin river by two shallow channels navigable only for boats.

Nyaungu, immediately above Pagan and on the same side of the river, is recognised by its cliffs which rise abruptly from the river side to a height of about 100 feet and are pierced with holes; this place is a calling station for the Irrawaddy Flotilla Co.'s steamers.

Kuniwa and Pa-ko-ko, the only villages of any size in this reach, lie on the right or western bank of the river. In the wet season

steamers call at Pa-ko-ko using the channel northward of the island opposite the village. In the dry season the channel lies to the southward of the island and continues along the southern bank. This bank a little above Kuniwa, has a rocky foreshore with off-lying rocks which make it very dangerous; the rocks are buoyed, and a European is kept by the Irrawaddy Flotilla Co. who is responsible for the buoyage. The course after these dangers are past is an ordinary one with two sharp turns before reaching Mingyin, 4 miles below which town is a 6 foot crossing.

Mingyin to Mandalay, a distance of 60 miles in wet and 65 in the dry season. General trend of river N. by E. for 22 miles towards Myinmu, then East 21 miles to Ava and from Ava N.N.E. 10 miles to Mandalay. The river for the first 15 miles of this reach is narrow, and the banks hard and strong, except the flat ground off the north end of Mingyin town: it is clear of shoals.

Samaitkyon is a pilot station on the eastern bank, a distance of 15 miles from Mingyin; above the village the river widens and the banks become low, the deep channel ultimately following either bank for about 3 miles at a stretch.

Nazum is a pilot station about 24 miles above Samaitkyon on the north bank, near the entrance of the Mu river, the mouth of which is dry in the month of January.

Ava, a picturesque former capital of Burma, is situated in an angle where the river turns from east to north in the direction of Mandalay. The town of Ava lies on the left or south bank, and from the walls which rise up from the river bank, a rocky shoal stretches more than half way across the river towards Sagain.

Sagain, a pretty district of pagodas and temples, lying on the opposite bank to Ava town, has a large sandflat, projecting from the river bank, which slopes off towards the east where vessels can go alongside the bank. A low range of hills, running north and south and visible from Myin-mu, terminates half a mile above Sagain point; large iron smelting works lie close to the south extremity of the hills. A large pagoda (Kaong-niu-dhau)* with a nipple shaped dome (conspicuous from the river) stands on the plain north-west of Sagain pagodas.

Vessels and barges filled with stones, were sunk opposite Ava, to prevent the British advance in 1885, but there is still a channel close to the sandflat off Sagain and another close to the Ava shore. It is probable that this dangerous portion of the river will shortly be improved and buoyed.

* Meaning a good act.

From Ava to Mandalay the channel runs between low lying islets, and is intricate. The Myitnge river, which enters the Irrawaddy at the N.E. salient of the walls of Ava, is navigable for boats drawing 6 feet for over 5 miles; in the month of January, the bar at the mouth of the river had only 5 feet over it.

Mandalay * is the capital of upper Burma. The town, about $1\frac{1}{2}$ miles from the river bank, is a square mile in extent, enclosed by a high thick brick wall and surrounded by a broad moat. There are four gates with bridges across this moat, facing the North, South, East, and West respectively. The palace lies nearly in the centre of the town, and is surrounded by a stockade of heavy timbers 15 to 20 feet high. Suburbs, of which the streets lie either north and south or east and west, broad but not metalled, extend to the river bank; the houses are mere native huts, with the exception of a few European dwellings, and monasteries. A large number of handsome temples stand both in the town and suburbs, some of which are gilt from roof to floor. A high embankment about a mile in length, protects the suburbs when the river is in flood.†

Amerapura, the ancient capital, prior to its being changed to Mandalay, lies about 4 miles to the southward on the left bank; it is principally interesting on account of its numerous pagodas and an old gun of large dimensions.

Mandalay to Kubwet,‡ a distance of about 50 miles in the wet and 56 in the dry season; general trend of river about north.

The first 38 miles, up to Ngasengu, the only village of any size with the exception of Shamagar, is shallow and irregular, the right bank being straight with low hills nearly to the water's edge, and the left bank having flat islets projecting from it, behind which are numerous creeks and marshes.

In the wet season the right bank is usually followed, up to the entrance of the 3rd defile which commences near Ngasengu.

The Madra discharges itself into this reach on the left bank 16 miles north of Mandalay, and forms a bar which carries on it only $6\frac{1}{2}$ feet in the dry season.

* Since the occupation of Mandalay by the British in December 1885, the town has altered considerably, new pukka houses having been built and streets made.

† In August 1886, the embankment gave way, the suburbs were flooded, and there was great loss of life.

‡ Or Thabyett. At Mingyin, 4 miles above Mandalay, on the right bank is a monster bell supposed to be the second largest in the world. There is also the ruins of the largest pagoda ever contemplated in Burma; this gigantic structure was rent from top to bottom by an earthquake before it was finished.

A long stretch of shallow water occurs 8 miles further north (known as the Henjaui bar), commencing a little above Shamagar; the crossings often carry as little as 4 feet, and in the driest time of the year cargo and passengers have sometimes to be transhipped by boats: there is another channel to the westward used in the wet season, known as the Ywathagi channel, from reports there is better water in it, but rocks are said to be numerous, and in the dry season it is not used.

Two or three miles above Ngasengu, hills covered with tall trees and thick bamboo undergrowth commence, and form the 3rd defile. In this defile the banks are steep and sometimes stony, while the centre is deep and clear.

Kubwet is a pilot station, and lies nearly in the middle of the 3rd defile on the right bank, about half a mile to the westward of where the river takes a sharp trend to the northward in about lat. $22^{\circ} 44' 20''$ N., long. $95^{\circ} 57'$ E.

Kubwet to Mya-daung, a distance of 70 miles. General direction north, the river after taking a trend due north to the eastward of Kubwet, continues through the 3rd or lower defile for about 9 miles, to Sa-bai-nago, a large village on its right bank, here it widens out to nearly a mile between the main banks and resumes its deltaic character, hills from 400 to 500 feet run down close to the water's edge in this reach on the right bank. The left bank is flat, though there is a range of mountains 4,000 to 6,000 feet high lying back about 6 miles and following the trend of the river to about 20 miles to the southward of Mya-daung. The channel is intricate, and there are two sharp crossings, one about 3 miles to the northward of Sa-bai-nago and the other about 12 miles further north.

Mya-daung, a large village, is a calling port and pilot station for the Irrawaddy flotilla.

Mya-daung to Modah, a distance of 45 miles. General trend N. by E. and N.E. by N. About 14 miles above Mya-daung, on the left bank, a large river called the Swali or Shewelé meets the Irrawaddy. The character of this reach is similar to the one below it.

From Modah to 6 miles S.W. of it, the main banks are from $2\frac{1}{2}$ to $2\frac{1}{2}$ miles apart: the islands that have formed in the bed of the river narrow the channel to about a quarter of a mile in width, the channel lying alternately along each bank.

Modah is a pilot and calling station.

Katha, on the right bank, is the only other village of importance in this reach; it contains many priests' houses and a few Chinese traders and Shans are met with; steamers call here, wood fuel is procurable at short notice; a lake lies at the back of the village.

Modah to Bhamo, a distance of about 53 miles. From Modah the river trends a little to the northward of east for 10 miles then to the southward past Shwékugi through the pass of the 2nd defile, where it again bends in a northerly direction and then flows in an easterly one for 10 miles, when it turns to the northward towards Bhamo.

The 2nd defile begins a little above Shwékugi, off which lies a large low island. About 4 miles from the above place is the pass, composed of a range of mountains from 800 to 2,000 feet high, through which the river flows, making a sharp bend through one of the valleys; the greatest depth found was 23 fathoms. In the freshets the eddies are so violent that it is with great difficulty steamers get through the pass, but in the dry season it is a quiet stream. The scenery is very fine, at one place the cliff rising perpendicularly 600 feet from the water. The entire length of the defile is 6 miles.

The character of this reach with exception of the defile is the same as the others; the river is narrower, and navigable to within $1\frac{1}{2}$ miles of Bhamo. The only place where there is any trade, is at Sinkah, built at the mouth of a small creek, down which the Maung-mah-taw timber rafts come to Shwé-kugi and Kong-ti, both small villages; their inhabitants being Shans and a few Chinese.

Bhamo, a small town enclosed by a stockade, was the frontier station of the Burmans. Large caravans from Yunnan arrive yearly with silks, skins, rubies, &c. Bhamo was captured by the Karins in 1885 and held for 3 months.

A range of mountains similar to those near Mandalay lies some 10 or 15 miles to the eastward of the town, the plains coming close up to their bases. These hills are peopled by the Kachens, a small but vigorous tribe.

The chief exports from Bhamo are furs, rubies, raw silk, &c. The principal imports are salt and cotton goods.

GENERAL RULES FOR MAKING PASSAGES AND FINDING THE CHANNELS.

The main banks of the Irrawaddy, generally distinguishable by high trees, pagodas, &c., are in the main stationary, but the shapes of the flat alluvial islands and banks facing them, are constantly being altered by the current. The channel rarely keeps to the same bank for more than 3 miles, a small projection from the bank being sufficient to deflect the water towards the opposite side; obstructions under water often exist, and cause the crossing to assume an S shape; this is the most difficult form of crossing, for which no guide can be given.

Great experience is requisite in the navigation of the river.

The cutting away of the banks is one of the best guides for ascertaining the channel, for as the full force of the water impinges on the bank, it crumbles away and falls in; the point of greatest cutting is often indicated by flocks of crows and gulls, feeding upon the insects thus exposed, whilst, floating off into mid-channel, are drift and earthy bubbles. The latter exist over any depth according to their size, from 2 feet diameter over 3 to 5 feet water, up to 8 feet over a depth of from 2 to 3 fathoms. As a rule the deep water shows the fastest surface stream; the pilots, coming down the river, watch the play of light on the water to detect the curves that the rapid moving is taking, through the dead water of the shallows.

A vessel should keep to the up stream sides of the crossings, so that in case of grounding, she may swing off into deeper water.

Climate.—The cold season begins about the middle of November at Thayetmyo, the mornings and evenings being cool, the former sometimes foggy. From November to the middle of February the weather is fine and pleasant, especially between Mandalay and Bhamo. The nights are cold, and a strong breeze sets in about 1 A.M., that should be guarded against; often as the wind drops, a thick fog comes on that lasts up to 10 to 11 A.M. The rainfall at Bhamo is reported to be heavy, and moderate at Mandalay, the lowest temperature observed on the 1st January at Bhamo was 52°, it has been known to fall to 45°.

The following observations were taken for the difference of the river level in the wet and dry season at

Donabyu	-	-	on the 18th January	-	24 feet.
Henzada	-	-	„ 17th „	-	30 „
Thayetmyo	-	-	„ 16th „	-	35 „
Yanan-yaung	-	-	„ 14th December	-	17 „

Estimated fall of the river at

Pagan	-	-	on the 22nd November	-	14 „
Mandalay	-	-	„ 10th January	-	12 „
20 miles above Mandalay	-	-	„ 4th December	-	8 „
In 3rd defile	-	-	„ 4th „	-	10 „
„ 2nd „	-	-	„ 28th „	-	9 „

The river fell 8 feet at Pagan between the 24th November and 13th January; 6 feet at Thayetmyo between 2nd and 12th November. It is reported to fall a foot daily at the end of October.

Pilot stations.—The following are the pilot stations between Thayetmyo and Bhamo,—Minhla, Magwe, Yananyaung (Nyung-la), Sem-bya-jun, Sillimyo, Nyaungu (Pagan), Kuniwa, Mingyin, Samaitkyon, Nazum, Mandalay, Kubwet or Thabyett, Mya-daung, Modah, Bhamo.

The following information, which is of interest, has been taken from the Rangoon pocket almanac 1884, and it is presumed that the distances quoted are only approximately correct.

ROUTES BY RIVER.

ROUTE No. 1, FROM RANGOON TO THAYETMYO.

DRY SEASON FROM ABOUT 15TH OCT. TO 15TH JUNE.

From Rangoon to entrance of Bassein Creek, 15 miles.

From entrance of Bassein to China Bakir river, 27 miles.

From China Bakir to Thonkwa, 46 miles, R. B.* Large village Native supplies available.

From Thonkwa to Ma-u-bin, 7 miles, R. B. Fair-sized village. Native supplies available in limited quantities.

From Ma-u-bin to Donabyu, 44 miles, R. B. Large village. Native supplies available.

From Donabyu to Zalun, 28 miles, R. B. Native supplies available.

From Zalun to Henzada, 19 miles, R. B. Large town. Supplies for both European and Native troops available.

From Henzada to Yei-king or Yegain-mengyi, 60 miles, R. B. Native supplies available.

From Yegain-mengyi to Myanaung, 14 miles, R. B. Native supplies available.

From Myanaung to Prome, 60 miles, L. B.† Large town. Supplies for both European and Native troops available.

From Prome to Thayetmyo, 44 miles, R. B. Large town. Supplies for both European and Native troops available. Frontier station.

Total distance from Rangoon to Thayetmyo, 364 miles.

NOTE.—Time taken in above passage in river steamers with two heavy flats, from 6 to 9 days. On emergency and with moonlight nights the trip could be done in from 4 to 5 days. The down passage from Thayetmyo to Rangoon follows the same route as the above, but the trip can be made in 3 days.

* R. B. denotes Right bank of river.

† L. B. „ Left „ „

ROUTE No. 2, FROM RANGOON TO THAYETMYO.

Monsoon route from about 15th June to 15th October.

From Rangoon to Mayzali creek, 23 miles, viâ Hline or Rangoon river.

From Mayzali creek to Panhlaing creek, Katlywa, 13 miles, R. B. Fair-sized village. Native supplies available.

From Panhlaing creek, Kattywa to Irrawaddy river, Nyaundung 24 miles, L. B. Large village. Native supplies and European supplies available in limited quantities.

From Irrawaddy river Nayaundung to Donabyu, 15 miles, R. B. *See* remarks in Route No. 1.

From Donabyu to Zalun, 28 miles, R. B. *See* remarks in Route No. 1.

From Zalun to Henzada, 19 miles, R. B. *See* remarks in Route No. 1.

From Henzada to Yegain-mengyi, 60 miles, R. B. *See* remarks in Route No. 1.

From Yegain-mengyi to Myanaung, 14 miles, R. B. *See* remarks in Route No. 1.

From Myanaung to Prome, 60 miles, L. B. *See* remarks in Route No. 1.

From Prome to Thayetmyo, 44 miles, R. B. *See* remarks in Route No. 1.

Total distance from Rangoon to Thayetmyo, 305 miles.

NOTE.—Time taken in above passage in river steamers with two heavy flats, from 5 to 8 days. On emergency and with favourable weather and moonlight nights, the passage could be done in about 4 days.

In the down passage from Thayetmyo to Rangoon the China Bakir route is adopted.

TABLE OF POSITIONS.*

Place.	Particular Spot.	Latitude, North.	Longitude, East.	Remarks.
CEYLON ISLAND.				
Colombo -	Clock tower -	6° 56' 21" 40	79° 50' 40" 30	Approximate. <i>(11. Coast of Hindustan Pilot Ed. 1891)</i>
Galle -	Lighthouse -	6° 1' 25"	80° 12' 32"	Captain Pullen, R. N.
Little Basses -	" -	6° 23' 0"	81° 43' 45"	{ Depends on Trincomali.
Great Basses -	" -	6° 10' 0"	81° 28' 30"	(Approximate).
Batticaloa -	Signal staff -	7° 44' 0"	81° 42' 00"	(Approximate).
Trincomali† -	Dockyard staff -	8° 33' 30"	81° 13' 42"	Captain Shad-
	Fort Frederick staff -	—	81° 15' 02"	well, R.N. 1853, and Captain Pullen, R.N., 1860.
Pámbam (Paumben) -	Lighthouse -	9° 17' 14"	79° 13' 10"	G. T. S.‡
HINDUSTÁN (EAST COAST.)				
Negapatam -	Lighthouse -	10° 45' 46"	79° 50' 58"	G. T. S.
Pondicherry -	Harbour office -	11° 55' 40"	79° 50' 12"	(Approximate).
Madras -	Observatory -	13° 4' 8"	80° 14' 51"	G. T. S.
Cocanada -	Hope island light-house.	16° 49' 5"	82° 18' 58"	G. T. S.
Vizagapatam -	Fort flagstaff -	17° 41' 34"	83° 17' 42"	G. T. S.
Kalingapatam -	Lighthouse -	18° 18' 57"	84° 7' 43"	} G. T. S.
	Port flagstaff -	18° 20' 36"	84° 7' 29"	
False point -	Lighthouse -	20° 20' 20"	86° 44' 0"	G. T. S.
Dhamra river	Budará G. T. S. pillar.	20° 45' 46"	86° 59' 18"	G. T. S.
Balasar road -	Chandipur flagstaff -	21° 25' 59"	87° 2' 25"	G. T. S.
Cowcolli -	Lighthouse -	21° 50' 10"	87° 56' 41"	G. T. S.
Saugor -	" -	21° 38' 40"	88° 2' 32"	G. T. S.
Diamond harbour	Top of custom house	22° 11' 40"	88° 9' 25"	G. T. S.
	Fort William flagstaff	22° 33' 32"	88° 20' 13"	G. T. S.
Calcutta -	" " time	22° 33' 25" 0	88° 20' 12"	G. T. S.
	ball.			

* The longitudes depend on Madras Observatory being in long. 80° 14' 51" E., (the telegraphic determination by the India Trigonometrical Survey, 1878,) except where otherwise stated.

† The longitude of Trincomali is the mean result of meridian distances to and from Madras Observatory, by Captain C. F. A. Shadwell, R.N., 1853, and Captain W. J. S. Pullen, R.N., 1860.

‡ Great Trigonometrical Survey.

TABLE OF POSITIONS.

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Place.	Particular Spot.	Latitude, North.	Longitude, East.	Remarks.
BURMA COAST.				
Meghna river -	Sitakund hill -	22 38 7	91 41 6	G. T. S.
Chittagong river -	Júldia flagstaff -	22 14 6	91 50 26	G. T. S.
Akyab -	Savage island light-house.	20 5 7	92 54 9	G. T. S.
Kyaukpyu -	Dalhousie point fort -	19 26 11	93 32 59	G. T. S.
Ramree harbour -	Tara-gu taung -	18 59 12	93 56 58	G. T. S.
Chedúba island -	Palangutaung -	18 40 53	93 41 30	G. T. S.
Diamond island -	Flagstaff -	15 51 30	94 15 20	Approximate.
Rangoon river]	Elephant point obelisk.	16 28 43	96 19 46	G. T. S.
Moulmein -	Shwe Dagon pagoda	16 47 51	96 9 8	G. T. S.
	Amherst point pagoda.	16 4 44	97 33 35	Nav. Lieut. Jarrad, R.N., approximate.
	Port office flagstaff -	16 28 58	97 37 17	Capt. Maurice Bean, I.M. approximate.
	Tavoy court-house -	14 4 18	98 11 46	G. T. S.
Tavoy river -	Bungalow at Tsin-byubin.	13 51 01	98 14 35	G. T. S.
	Landing place on east side of Reef island.	13 36 14	98 12 33	G. T. S.
Mergui harbour -	S.E. corner of court-house.	12 26 15	98 35 59	G. T. S.
Sayer islands -	N.E. point of South island.	8 29 01	97 39 03	Depends on Penang and Singapore.

SIAM (WEST COAST.)

Puket (Tonkah) harbour.	Harbour master's office.	7 51 12	98 24 0	Com. Richelieu, (Siamese Imperial Navy), approximate.
Brothers islands -	South part of North island.	7 29 27	98 19 19	Depends on Penang and Singapore.

NORTH COAST SUMATRA.

Pulo Brasse -	Lighthouse -	5 45 0	95 4 15	Netherlands Government Survey, 1872 -4.
Achi (Acheen) river -	East entrance point -	5 35 35	95 20 45	" "

A A 2

TABLE OF POSITIONS.

Place.	Particular Spot.	Latitude, North.	Longitude, East.	Remarks.
NICOBAR ISLANDS.*				
Great Nicobar island -	South (Galathea) bay, Observation spot.	6° 48' 26"	93° 49' 45"	A. I. F. <i>Novara</i> , 1858.
St. George's channel -	Kondul island, Observation spot.	7 12 17	93 39 55	" "
Nankauri harbour -	Karmorta island, Observation spot, S.E. point.	8 2 10	93 29 42	" "
Tillangchong island -	Morrok (Novara) bay.	8 32 30	93 34 10	" "
Kar Nicobar island -	Komios bay -	9 7 32	92 43 42	" "
	Saoui bay, Observation spot.	9 14 8	92 44 53	" "
ANDAMAN ISLANDS.				
South Andaman island.	Port Blair, Observatory on Chatham island.	11 41 18	92 43 0	G. T. S., 202 observations of lunar zenith dist., and 29 culminations.
	Port Meadows, Entry island.	12 0 30	92 45 30	(E. Cooke, R.N.), approximate.
	Port Mouat, Perseus point.	11 38 45	92 34 30	Approximate.
	Port Campbell, Petries island.	12 1 0	92 33 0	Lieut. Arch. Blair, I.N., approximate.
Great Andaman island	Port Cornwallis, First South point.	13 17 0	93 01 45	" "

* The longitudes of the observation spots in the Nicobar islands differ from 2" to 7" of arc from those tabulated at p. 131, Vol. II. of the "Voyage of the *Novara*."

GLOSSARY

OF A FEW TERMS USED IN CHARTS AND SAILING DIRECTIONS.

Numerous languages and dialects are embraced on the various coasts treated of in the Bay of Bengal Pilot. On the south-west and south coast of Ceylon, Sinhalese is the language; on the north and east coasts of the same island, Tamil. Around the coast of Palk bay, Tamil or Malayalam is the language; advancing north, this gives way to Hindustáni, which again, as the north-west part of the bay is approached, is superseded by Bengali. On the east coast of the bay of Bengal Arakanese is spoken, Burmese, and further to the south, Malay. The language of the Nicobar islands consists of various dialects spoken at different islands of the group, none of which have been written; that of Kar Nicobar is the best known. In the south part of the Andaman islands efforts have been made of late years to construct a dictionary of the native language, but the dialects here again are many, and progress in this respect has been slow.*

English.	Hindustáni.	Bengali.	Burmese.	Malay.
Mountain or hill.	Giri; pahár (par).	- -	Taung -	Gunong.
Island -	Jinjira; díp; lanka	- -	Gyun -	Pulau; Pulo.
River -	Kári -	- -	Myit -	Batang, Sung-ei.
Creek -	Nadi; nullah -	Khal -	Chaung -	Jurang, churang.
Opening -	- -	- -	Wa -	Lapong.
Village -	Chota Gam -	- -	Yua -	Kampong.
Town -	Bara Gam -	- -	Myo; Daung	Nagri.
Communication	- -	- -	Galit	
Pagoda -	- -	- -	Kyaung.	
Lake -	- -	- -	In -	Danau; tasek.
Point -	Karú -	- -	- -	Ujong; Tanjong.
Sandbank -	Balu Danda -	Char -	- -	Beting.
Market town -	- -	Ganj -	- -	Pakau; pasar.
Small -	- -	- -	Nge -	Kechil.

* See List of Andamanese names by Mr. E. H. Man and Lieut. R. C. Temple, in the Royal Geographical Society's Journal for 1880, p. 256, 259.

MONEY, WEIGHTS AND MEASURES.

The Gold coin is the *Mohur* = 16 Rupees. The current money is one Rupee = 16 annas; 1 anna = 12 pie.

The weight of the Gold Mohur and that of the current Rupee is the same, *viz.*, 180 grains Troy. Sicca Rupees are referred to in the Money Market, but not issued; 100 Sicca Rupees are equal to 106-10-8 current Rupees.

To convert Sicca Rupees into current, add $\frac{1}{15}$ th; and current Rupees into Sicca, deduct $\frac{1}{16}$ th.

Bazár Weight.—16 Chittacks = one seer, or 2 lbs. 0 oz. 13 drs.; 40 seers = 1 maund, or 82 lbs. 2 oz. 3 drs.; 100 Bazar maunds = 110 Factory; $1\frac{1}{2}$ Factory maunds = 1 cwt.

Factory Weight.—16 Chittacks = 1 seer, or 1 lb. 13 ozs. 14 drs.; and 40 seers = 1 maund, = 74 lbs. 10 ozs. 14 drs. The Indian maund = $82\frac{2}{7}$ lbs. Avoirdupois Weight.

BRITISH INDIAN MONEY :—

1 Pie	-	-	-	-	marked P.	=	$\frac{1}{2}$	Farthing.
3 Pie	-	-	make 1 Pice	-	„ Ps.	=	$1\frac{1}{2}$	„
8 Pie	-	-	-	-	„	=	1	Penny.
4 Pice or 12 Pie	-	„	1 Anna	-	„ A.	=	$1\frac{1}{2}$	Pence.
16 Annas	-	-	„ 1 Rupee	„	R.	=	2	Shillings.
16 Rupees	-	-	„ 1 Gold Mohur	„	G.M.	=	32	„

N.B.—The relative value of the money of India and England fluctuates; thus a Rupee is sometimes worth 2s. 2d., and sometimes only 1s. 7d., but 2s. is the par value.

Cowries (*Cypræa moneta*), or small shells, are also made use of for fractional payments. Their value is subject to fluctuations. They are reckoned in Bengal :—

4 Cowries	-	-	-	-	make 1	Gunda.
20 Gundas	-	-	-	-	„	1 Pun.
5 Puns	-	-	-	-	„	1 Anna.

BRITISH INDIAN WEIGHT :—

The following are the weights in general use.* The unit is the Tola, equal to 180 grains English Troy Weight. From it, upwards, are derived the heavy weights, *viz.*, *Chittack*, *Seer*, and *Maund*; and by its subdivision, the small or jeweller's weights called *Mashas*, *Ruttis*, and *Dhans*.

* By the Indian Weights and Measures of Capacity Act, 1871, it is enacted throughout British India the *Seer* or *Ser* shall be the primary standard of weight, and that it shall be equal, when weighed in a vacuum, to the weight known in France as the *Kilogramme des Archives*. The units of weights and of measures of capacity shall be for Weights, the said *Seer*; for measures of capacity, a measure containing one such *Seer* of water at its maximum density, weighed in a vacuum.

The following Table gives both the series :—

1 Dhan or grain }	-	=	$\frac{1}{32}$	grain Troy	=	$\frac{3}{175}$	dr. Avoir.
4 Dhans	= 1 Ruttí	=	$1\frac{7}{8}$	"	=	$\frac{17}{175}$	"
8 Ruttis	= 1 Masha	=	15	"	=	$\frac{96}{375}$	"
12 Mashas	= 1 Tola	=	7 dwt. 12	"	=	$6\frac{10}{175}$	"
5 Tolas	= 1 Chittack	=	1 oz. $17\frac{1}{2}$ dwt.	Troy	=	$2\frac{2}{35}$	oz. "
16 Chittacks	= 1 Seer	=	$2\frac{1}{4}$ lbs.	Troy	=	$2\frac{2}{35}$	lbs. "
40 Seers	= 1 Maund	=	100 lbs.	Troy	=	$82\frac{2}{7}$	lbs. "

The Maund is equal to 100 English pounds Troy, and 35 Seers are equal to 72 pounds Avoirdupois.

To convert Indian Weight into Avoirdupois.—Multiply the weight in Seers by 72, and divide by 35 ; the result will be the weight in lbs. Avoirdupois. Or, multiply the weight in Maunds by 36, and divide by 49 ; the result will be the weight in cwt. Avoirdupois.

To Convert Avoirdupois Weight into Indian Weight.—Multiply the weight in lbs. Avoirdupois by 35, and divide by 72 ; or multiply the weight in cwt. by 49, and divide by 36 ; the result will be the weight—in the former, in Seers—in the latter in Maunds.

A Ton is equal to 27·222 Maunds, or $27\frac{1}{4}$ Maunds nearly.

BAZÁR WEIGHT.

5 Sicki or Quarter	
Rupee make	- 1 Cancha.
4 Cancha make	- 1 Chittack.
4 Chittacks, or 20 Tolas	
make	- 1 Powá.
4 Powás make	- 1 Seer.
5 Seers make	- 1 Pusserí.
3 Pusserís, or 40 Seers	
make	- 1 Maund.

To reduce Bazár weight into Factory weight, add 1-10th.

Thus ; 3,000 Bazár Maunds.

Add 1-10th 300

3,300 Factory Maunds.

To reduce Bazar weight into cwt., add 1-10th and deduct 1-3rd of that sum, the remainder will be cwt.

Thus ; 3,000 Bazar Maunds.

Add 1-10th 300

3,300

Deduct 1-3rd 1,100

Remainder 2,200 Cwt.

To reduce Factory Maunds into Tons, divide by 30, and the quotient will be the answer.

Thus ; Factory Maunds 3,000 ÷ 30 = 100 Tons.

The kilogramme equals 15432·34880 grains ; 32·150727 ounces, Troy ; 2·2046213 pounds avoirdupois ; 0·01968412 cwt. of 112 lbs. ; 0·000984206 ton of 20 cwt.

One hundredweight of 112 lbs. equals 50·80237689 kilogrammes ; 1 lb. avoirdupois 0·45359265 kilogramme ; 1 ounce, troy, 31·103496 grammes ; 1 grain 0·064798950 graume.

LINEAL MEASURE.—Though the cubit or human forearm is the basis or unit in Oriental and Western countries, there is no fixed standard established in India.

In Bengal the measure generally used is the following :—

1 Hath (Cubic)	-	-	=	18 inches.
4 Haths	=	1 Danda (or Bam)	=	2 Yards.
1,000 Dandas	=	1 Coss (or Kos)	-	= 2,000 „

The Coss or Bengal mile is equal to 1 mile, 1 furlong, 3 poles, $3\frac{1}{2}$ yards, English.

In the North-west Provinces, the average length of the coss is about 2 miles; but it differs in almost every province in the country. For instance, in Agra and Muttra, it is about $1\frac{3}{4}$ miles; towards the Hills the coss is a little more than a mile; while in Bundelcund it is three times as long as in other parts, and is called a *Páka Coss*.

MARINEI'S COMPASS.

English.	Hindustáni.	Bengali.	Malay.	Burmese.
North -	Gí - - -	Úttá - - -	Útára - - -	Miauk.
N. by E. -	Gí wíjau choki -	Úttá ek nishan kona -	_____	_____
N.N.E. -	Gí wíjau tír -	Úttá do nishan kona -	Útára sa-máta timor	_____
N.E. by N. -	Gí wíjau tír wíjau choki.	Úttá tín nishan kona -	_____	_____
N.E. -	Gí wíjau arkrop -	Nishan kona -	Timorlaut or útára Timor.	Ashi Miauk.
N.E. by E. -	Gí wíjau arkrop wíjau choki.	Mutlu tín nishan kona	_____	_____
E.N.E. -	Mutli dau tír -	Mutlu do nishan kona -	Timor sa-máta útára	_____
E. by N. -	Mutli dau choki -	Mutlu ek nishan kona -	_____	_____
East -	Mutli -	Púrúb mutlu -	Timor or timor tapat	Ashi.
E. by S. -	Mutli wíjau choki -	Mutlu ek súlí mutlu -	_____	_____
E.S.E. -	Mutli wíjau tír -	Mutlu do súlí mutlu -	Timor tangára or menoungára.	_____
S.E. by E. -	Súli dau arkrop dau choki.	Mutlu tín súlí mutlu -	_____	_____
S.E. -	Súli dau arkrop -	Sulí mutlu -	Tangára or menoun-gára.	Ashi-Taung.
S.E. by S. -	Súli dau arkrop wíjau choki.	Sulí tín sulí mutlu -	_____	_____
S.S.E. -	Súli dau tír -	Sulí do sulí mutlu -	Salátan menoungára	_____
S. by E. -	Súli dau choki -	Sulí ek sulí mutlu -	_____	_____
South -	Súli -	Sulí -	Salátan - - -	Taung.
S. by W. -	Súli wíjau choki -	Sulí ek sulí kiblu -	_____	_____
S.S.W. -	Súli wíjau tír -	Sulí do sulí kiblu -	Salátan dáya - -	_____
S.W. by S. -	Súli wíjau arkrop dau choki.	Sulí tín sulí kiblu -	_____	_____
S.W. -	Súli wíjau arkrop -	Sulí kiblu ukurub -	Bárat dáya - -	Anaut Taung.
S.W. by W. -	Súli wíjau arkrop wíjau choki.	Kiblu tín sulí kiblu -	_____	_____
W.S.W. -	Kabli dau tír -	Kiblu do sulí kiblu -	Bárat sa-máta salátan	_____
W. by S. -	Kabli dau choki -	Kiblu ek sulí kiblu -	_____	_____
West -	Kabli -	Kiblu -	Bárat or bárat tapat	Anaut.
W. by N. -	Kabli wíjau choki -	Kiblu ek agní kona -	_____	_____
W.N.W. -	Kabli wíjau tír -	Kiblu do agní kona -	Bárat sa-máta útára	_____
N.W. by W. -	Gí dau arkrop dau choki.	Agní kona -	_____	_____
N.W. -	Gí dau arkrop -	Agní kona -	Bárat laut - -	Anaut Miauk.
N.W. by N. -	Gí dau tír dau choki -	Úttá tín agní kona -	_____	_____
N.N.W. -	Gí dau tír -	Úttá do agní kona -	Útára bárat laut -	_____
N. by W. -	Gí dau choki -	Úttá ek agní kona -	_____	_____

**Monthly Statement of Currents and Winds
on the Coasts of Ceylon, as experienced
in 100 Voyages round that Island by Mr.
Thomas Robson, Commander of the
Colonial Government Steamer "Seren-
dib," during the five years July 1881 to
September 1886.***

* The results given for the months are the averages of the five years 1881-6.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON.

JANUARY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	N.N.W.	Strong	N.N.E.	Moderate	The prevailing winds are from north to north-east, moderate in the morning and stronger in the afternoon. The weather is generally fine.
Between Pambam and Jafna.	1 to 2	Tidal ebb northerly, flood southerly.	Strong	N.E.	Moderate	The tidal stream sets through between the islands, the ebb in a northerly and flood in a southerly direction. The north-east winds are strong with a nasty short chopping sea, but fine weather is found in the bay.
Between Jafna and point Pedro.	1 to 2	Tidal ebb easterly, and flood westerly.	Strong	N.E.	High	On the north coast the north-east winds are strong and a high turbulent sea, especially on the ebb tide. The flood tide is very strong at times.
Between point Pedro and Trincomali.	1‡	S.E.	Moderate	N.E.	Moderate	The weather is in general cloudy and squally with rain, but fine weather is experienced towards the end of the month.
Between Trincomali and Batticaloa.	1‡	S.E.	Moderate	Northerly	Moderate	There is a very strong outset from the rivers at Trincomali and the Virgel and Velaichenal and Arrogan when there are heavy rains up country; this causes a very rough sea at times on the coast.
Between Batticaloa and Little Basses.	2	S.S.W.	Fresh	N.E.	High	The north-east winds are very strong and the sea rough, and just outside the range of the Little Basses to the eastward the current sets strong to the S.S.E.
Between Little Basses and Hambantotti.	2‡	S.W.	Strong	N.E.	High	The north-east wind is strong as far as Hambantotti, but the sea is more regular than on the east coast; the current runs very strong to the west-south-west.
Between Hambantotti and Galle.	1‡	W.S.W.	Strong	N.E.	Moderate	Between Hambantotti and Galle the wind and sea are more moderate and the current less with fine clear weather.
Between Galle and Colombo.	‡	N.N.W.	Light	N.N.E.	Moderate	The winds between Galle and Colombo are from N.N.W. to N.N.E. Sometimes a squall from the east, but the weather is generally fine and clear.

MONTHLY STATEMENT OF CURRENTS AND WINDS on the COASTS of CEYLON—continued.

FEBRUARY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	North-westerly.	Fresh	N.E.	Moderate	The prevailing wind is N.N.E. blowing fresh with clear weather and moderate sea. The sea is very smooth at the head of the Gulf.
Between Pambam and Jaina.	1 to 2	Tidal ebb northerly, flood southerly.	Fresh	N.E.	Smooth	Fresh N.E. winds and clear with smooth water except on the flood tide and south-east winds. On the ebb tide with as strong northerly wind which causes a short chopping sea very bad for small vessels.
Between Jaina and point Pedro.	1 to 2	Tidal ebb easterly, and flood westerly.	Fresh	N.E.	Moderate	The winds are inclined more easterly and clear weather with moderate sea, except on the ebb tide.
Between point Pedro and Trincomali.	1	N.W.	Light	N.E.	Smooth	Moderate E.S.E. to N.E. winds and clear weather with a moderate sea: near Trincomali calms and light variable winds prevail at times.
Between Trincomali and Batticaloa.	‡	S.S.E.	Moderate	N.E.	Smooth	Moderate easterly winds and clear with moderate sea, but at times there is a heavy swell from the N.E. causing a heavy surf on the bar at Batticaloa.
Between Batticaloa and Little Basses.	‡	S.S.E. to S.S.W.	Moderate to fresh.	N.E. to East.	Moderate	Light N.N.E. winds and fine weather with a moderate sea.
Between Little Basses and Hambantotti.	1‡	W.S.W.	Fresh	N.E. to East.	Moderate	Moderate easterly winds and clear, and on a few occasions there is squalls of wind and rain from the land.
Between Hambantotti and Galle.	1	W.S.W. to W.N.W.	Moderate	N.E.	Moderate	Light winds from E.S.E. to N.N.E. and fine clear weather with smooth water.
Between Galle and Colombo.	‡	N.N.W.	Moderate	Northerly	Smooth	At the beginning of the month light N.E. breezes and cloudy, but at the end of the month the wind becomes variable with occasional showers at night when the land wind comes off shore.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

MARCH.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ½ to ¾	N.W.	Moderate	North to N.E.	Smooth	Moderate north and N.E. winds and fine weather with passing showers of rain. Very hot sultry weather and hazy over the land.
Between Pambam and Jafna.	Tidal 1½ to 2½	Tidal ebb northerly and flood southerly.	Light	Variable	Smooth	Light variable winds and calms. The weather is fine but very hazy at times.
Between Jafna and point Pedro.	Tidal 1½ to 2½	Tidal ebb easterly and flood westerly.	Light	N.E.	Smooth	The prevailing wind is north-east, but light variable winds and calms are the rule.
Between point Pedro and Trincomali.	½ to 1	N.N.W.	Light	N.E.	Smooth	Light north-east and easterly winds, but they are very unsteady. The weather is fine.
Between Trincomali and Batticaloa.	1 to 1½	N.N.W.	Light	E.S.E.	Smooth	Light variable winds and fine weather. The prevailing winds are easterly. Very hazy over the land.
Between Batticaloa and Little Bassae.	½ to ¾	N.N.E.	Light	Land and sea breezes.	Smooth	Light variable land and sea breezes. Very cloudy over the land.
Between Little Passae and Hambantotti.	½ to ¾	Westerly	Light	East to N.E.	Smooth	Light land and sea breezes, the prevailing winds are from the eastward. The currents are very slight and set with the wind generally.
Between Hambantotti and Galle.	½ to ¾	Westerly	Light	N.E. and S.W.	Smooth	Light variable winds and fine weather. Very cloudy appearance over the land.
Between Galle and Colombo.	No current		Light	Variable	Smooth	Light unsteady winds and cloudy hazy weather. It is also very close, hot, sultry weather, with dark clouds over the land at times.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

APRIL.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ½ to ¾	Northerly	Light	S.W.	Smooth	The winds are light and very unsteady. Very hot sultry weather. Land and sea breezes at times.
Between Pambam and Jafna.	Tidal 1½ to 2½	Tidal ebb northerly and flood southerly.	Light	South to S.E.	Smooth	Light variable winds. Land and sea breezes. Very close, hot, sultry weather.
Between Jafna and point Pedro.	Tidal 1½ to 2½	Tidal ebb easterly and flood westerly.	Light	Variable	Smooth	Light variable winds, mostly from the southward. Very hot, sultry weather.
Between point Pedro and Trincomali.	1½ to 2½	N.W.	Light	Variable and easterly.	Smooth	Light easterly and variable winds, and calms with fine clear weather.
Between Trincomali and Batticaloa.	½ to 1	N.N.W.	Light	Variable and easterly.	Smooth	Light easterly winds and calms. Very hazy over the land, but fine weather.
Between Batticaloa and Little Basses.	½ to ¾	N.N.E.	Light	Land and sea breezes.	Smooth	Light S.E. and variable winds. Very fine weather. Hazy over the land.
Between Little Basses and Hambantotti.	½ to ¾	Westerly	Light	N.E. to East	Smooth	Light S.E. winds, sometimes calm and variable. Very cloudy over the land, with occasional showers of rain.
Between Hambantotti and Galle.	½ to ¾	Westerly	Light	N.E. to S.W.	Smooth	Light variable winds, mostly from the southward. Sometimes calms prevail with very hot sultry weather.
Between Galle and Colombo.	No current	No current	Light	Variable	Smooth	Light variable winds and calms. Very hot, sultry weather during the day time with light showers at night. Very cloudy over the land.

MONTHLY STATEMENT OF CURRENTS AND WINDS on the COASTS of CEYLON—continued.

MAY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. $\frac{1}{4}$	N.N.E.	Strong	S.W.	High sea	Winds mostly S.W., unsteady at times, squally with rain, and gale sometime sets in, beginning at south and ending W.S.W., the squalls heavy.
Between Pambam and Jafna.	Tidal $1\frac{1}{2}$ to 2	Current S.E. & N.W.	Brisk	S.W. to S.	Smooth	The weather is very uncertain with occasional spells of squally weather; had a strong W.S.W. gale in 1886, being the S.W. verge of a cyclone at Madras.
Between Jafna and point Pedro.	Tidal $1\frac{1}{2}$ to 2	Current E. & W.	Light to fresh.	S.W.	Smooth	The prevailing winds are from S.W. with light variable winds at times. A gale or cyclone in the Bay of Bengal sends in a heavy easterly swell on the north coast of Ceylon.
Between point Pedro and Trincomali.	$1\frac{1}{2}$	N.N.W.	Fresh	S.W.	Smooth	Generally fresh S.W. winds and fine weather, and smooth sea. In 1886 when anchored on the Muletiu shoals on two different occasions I found a current setting $2\frac{1}{2}$ knots to the N.W.
Between Trincomali and Batticaloa.	Nil	Nil	Moderate	E.S.E. & W.N.W.	Smooth	Between Trincomali and Batticaloa land and sea breezes prevail A.M. from the west, and P.M. E.S.E. The weather is fine, with squalls over the land at times, with much lightning and thunder to the westward.
Between Batticaloa and Little Basses.	$1\frac{1}{2}$	N.N.E.	Strong	S.W.	Moderate	From Batticaloa to about 20 miles south land and sea breezes prevail, with fine weather and smooth water. From Karativu strong S.W. winds prevail with a high southerly sea, much lightning and thunder over the land. May 1886 had a one-knot current setting S.S.W., very exceptional.
Between Little Basses and Hambarottli.	$1\frac{1}{2}$	E.N.E.	Strong	S.W.	Moderate	Between Hambarottli and Little Basses the prevailing winds are S.W., strong and squally at times.
Between Hambarottli and Galle.	1	Easterly	Strong	S.W.	Moderate	The S.W. monsoon begins about the middle of the month and is strong and squally at times with a high southerly swell.
Between Galle and Colombo.	$\frac{1}{2}$	Southerly	Moderate	S.W.	Moderate	Is the same, but the swell is from W.S.W., and when the current crosses this swell it causes a very high turbulent sea.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

JUNE.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	Northerly	Fresh	S.W.	High sea	Strong S.W. monsoon with occasional spells of squally, cloudy, rainy weather. I always find the strongest winds and most turbulent sea right across the gulf about half way between Colombo and Pambam.
Between Pambam and Jafna.	1½ to 2	Tidal S.E. & N.W.	Fresh	S.W.	Smooth	Weather generally fine but hazy with a few squalls occasionally; the weather as a rule is altogether better than in the Gulf of Manaar.
Between Jafna and point Pedro.	1½ to 2	E. & W.	Fresh	S.W.	Smooth	Weather generally fine, the wind veers to the southward during the night.
Between point Pedro and Trincomali.	‡	N.N.W.	Fresh	S.W.	Smooth	Fine weather, hazy at times, fresh land winds from W.S.W. and S.W., sea smooth. Small sailing vessels make a passage either up or down the coast quite easily.
Between Trincomali and Batticaloa.	None	None	Fresh	W.S.W.	Smooth	Fresh westerly winds from Trincomali to Vendeli Bay, generally westerly winds at Batticaloa from 8 p.m. to 10 a.m., calm at midday and light E.S.E. sea breeze in afternoon.
Between Batticaloa and Little Basses.	‡	Southerly	Fresh	S.W.	High sea	From Batticaloa to 30 miles south light wind in the night and sea breeze S.E. in the afternoon. From Aganis to Little Basses nearly always southerly and S.W. winds, after increasing to a gale in the afternoon with a very high cross sea caused by a slight southerly set of current as far as Little Basses.
Between Little Basses and Hambantotti.	Nil	Nil	Fresh	W.S.W.	High sea	The sea and wind always moderates when near Hambantotti. A thick haze generally over the land.
Between Hambantotti and Galle.	1	E. & E.N.E.	Fresh	W.S.W.	High sea	Squalls with rain, occasionally with high turbulent sea, generally cloudy weather and hazy over the land; the strength of the current depends on the strength of the wind; there is always a long southerly swell.
Between Galle and Colombo.	‡	Southerly	Moderate	W.S.W.	Moderate	There is always a heavy S.W. swell, the wind varies from S.W. west and W.S.W. blowing fresh at times. The current generally sets to the S.S.E. between Kattura and Galle. It often happens that if Galle light is not sighted, that all vessels find themselves a long way south of their reckoning.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.
JULY.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	Northerly	Fresh	S.W.	Moderately high.	There is generally fresh breezes and cloudy hazy weather during the month in the gulf of Manar; the wind moderates when near the head of the gulf in the morning, but blows very strong again in the afternoon.
Between Pambam and Jafna.	Tidal current, 1 to 2	S.E. and N.W.	Moderate	S.W.	Smooth	The S.W. winds prevail, but occasionally S.E. and N.W. are experienced when the weather is settled and fine. The sea is smooth, but in strong afternoon breezes it gets very turbulent and short chopping sea, when the tides are setting against the wind, very bad for small boats.
Between Jafna and point Pedro.	Tidal, 1 to 2	E. and W.	Moderate	W.S.W.	Smooth	W.S.W. winds prevail during the day time, veering to the southward at night, and is rather gusty at times.
Between point Pedro and Trincomali.	1	N.N.W.	Fresh	S.W.	Smooth	The westerly or land winds prevail, with smooth sea. The current is much stronger when near Muleivu shoals, which I found on each trip I made when attending upon the salvage party at the wreck of the P. & O. S.S. "Indus."
Between Trincomali and Batticaloa.	None	None	Moderate	S.W.	Smooth	Strong land winds and smooth water between Trincomali and Vendelias, but from Vendelias to Batticaloa the land wind blows from about 10 p.m. until the next noon, then generally a S.E. sea breeze sets in. It is squally in the evening sometimes.
Between Batticaloa and Little Basses.	‡	Southerly	Moderate	S.W.	Moderate	From Batticaloa the wind is from the westward in the morning and S.E. in the afternoon as far as Aganis. Between Aganis and Little Basses the southerly and S.W. winds are very strong, with a high sea, caused by a slight southerly set of current; it is very hazy over the land.
Between Little Basses and Hambantotti.	1	E.N.E.	Fresh	S.W.	High	The wind and sea moderates when near Hambantotti.
Between Hambantotti and Galle.	‡	Easterly	Fresh	W.S.W.	High	The prevailing winds are west and W.S.W., moderate during the night, light in the mornings, and strong in the afternoon; the southerly swell is constant and heavy. A strong westerly wind causes a cross sea, and the current increases. It is always hazy over the land, and is very deceiving in judging distances. The weather is squally, with rain at times.
Between Galle and Colombo.	Slight	Southerly	Moderate	W.S.W. to W.N.W.	Moderate	The prevailing winds are from west and W.S.W.; the afternoon winds are generally the strongest; there are occasional squalls of wind and rain. When the wind is strong from the westward there is generally a very high cross sea. It is hazy and cloudy over the land, especially in the early morning.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.
AUGUST.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	Northerly	Fresh	W.S.W.	High	The prevailing winds are from S.S.W. to W.S.W., with generally fine weather, but there are occasional squalls with heavy rain. There is always a heavy swell from the W.S.W., and I always find there are stronger winds and more sea about half way between the two ports than there is when near either of them.
Between Pambam and Jafna.	1½ to 2	Tidal ebb northerly and flood southerly.	Strong	S.W.	Smooth	The wind generally shifts from S.W. to south when leaving Pambam, but the prevailing wind is S.W., fresh, with sudden gusts.
Between Jafna and point Pedro.	1½ to 2	Tidal ebb easterly and flood westerly.	Fresh	S.W.	Smooth	The prevailing wind on the North Coast is from W.S.W. to south; it is generally very strong and puffy, in the day time W.S.W., and veering to the southward at night, similar to land and sea breezes. At anchor off Kankasentorai the tides are very regular.
Between point Pedro and Trincomali.	1 to 2	N.W.	Fresh	W.S.W.	Smooth	The prevailing winds are from W.S.W., blowing very fresh at times. The currents are not steady, for in August 1885 and 1886 I had a 2½-knot current setting to the N.W. The weather is fine, but hazy over the land.
Between Trincomali and Batticaloa.	‡	Northerly	Fresh	W.S.W.	Smooth	The prevailing winds are from W.S.W., blowing fresh from Trincomali as far as Vendelus Bay, where it drops suddenly at mid-day, and a light southerly or S.E. wind sets in and continues until sunset. At Batticaloa it is the same, and at 10 p.m. the wind comes off the land. It falls calm in the early morning.
Between Batticaloa and Little Basses.	1	N.N.E.	Fresh	S.W.	High	Light land and sea breezes from Batticaloa to Kalmuni, and from Kalmuni to the Little Basses the S.S.W. wind is very strong in the afternoon, with a heavy southerly swell, and sometimes the current sets S.S.W. 1 knot per hour, which causes a very high turbulent sea. This also continues the same as far as Hambantotti, where it gets more moderate.
Between Little Basses and Hambantotti.	1	E.N.E.	Fresh	S.W.	High	The winds and weather is the same from the Little Basses to Hambantotti. The prevailing wind is from W.S.W.; the weather is hazy and cloudy, with occasional squalls of wind and rain; the heavy S.W. swell is constant, and when the wind is strong from W.S.W. to west there is a very high sea.
Between Hambantotti and Galle.	‡	Easterly	Fresh	W.S.W.	High	The prevailing winds are from S.W. and W.S.W., although it hails as far as W.N.W. at times; the afternoon breeze is the strongest; there are occasional spells of rain and squalls, with a very heavy S.W. swell. The current sets past Point de Galle to the S.S.E. Ships are often drifted off the land while lying-to waiting for daylight to go into Galle harbour.
Between Galle and Colombo.	1	S.S.E.	Fresh	S.W. by W.	High	

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

SEPTEMBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ‡	Northerly	Fresh	W.S.W.	High	The prevailing winds are from S.W. to west and blow fresh with a high turbulent sea. Weather fine but hazy. The wind is strongest about half way between Colombo and Pambam.
Between Pambam and Jafna.	1 to 2	Tidal ebb northerly, flood southerly.	Moderate	S.S.E.	Smooth	
Between Jafna and point Pedro.	1 to 2	Tidal ebb easterly and flood westerly.	Moderate	South to W.S.W.	Smooth	The wind north of Rameswaram is generally from the S.S.E. Moderate and fine weather, hazy at times with lightning to the N.E. The direction of tides is variable through the islands in the bay.
Between point Pedro and Trincomali.	‡	Southerly	Fresh	S.W.	Smooth	During the day the wind is from W.S.W., but during the night from S.S.W., and very puffy off shore at times. It is generally very cloudy to the westward.
Between Trincomali and Batticaloa.	No current		Moderate	S.W. to S.E.	Moderate	
Between Batticaloa and Little Basses.	1	S.S.W.	Light to fresh.	S.E. to S.W.	Moderate to high.	The winds are very unsteady, but mostly fresh W.S.W. with squalls and rain at times. The weather begins to get cloudy over the land with lightning. The winds are fresh about Trincomali from S.W. to W.S.W. with clear weather. Sometimes a smart squall of wind and rain. The wind nearly always falls light off Batticaloa with land winds from W.S.W. at night and S.E. in the afternoon. This continues about 20 miles south of Batticaloa.
Between Little Basses and Hambantotti.	1‡	E.N.E.	Fresh	S.W.	High	On the S.E. coast near the Little Basses the S.W. winds are very strong in the afternoon, and the current setting against the wind and the usual southerly swell causes a high turbulent sea off the Great Basses. It is more moderate after midnight.
						I find the P.M. winds always fresh and the A.M. very moderate between the Little Basses and Hambantotti. The weather is hazy, especially over the land and is very deceiving in judging distance off shore. In 1886 when attending upon the Basses lighthouses I found the current very strong inside the reefs owing to the E.N.E. (sometimes squally with rain, but very seldom). This E.S.E. current meeting the S.S.W. current causes a set to the S.E. off the Little Basses, many vessels are drifted to S.E. thereby.
Between Hambantotti and Galle.	‡	Easterly	Moderate	W.S.W.	High	On the south coast fresh W.S.W. winds, high sea and hazy weather. It is generally cloudy and squally off Point de Galle and very hazy.
Between Galle and Colombo.	Slight	Southerly	Moderate	West	High	Between Galle and Colombo moderate breezes from W.S.W. to W.N.W., fine weather, hazy over the land, the heavy S.W. swell continues throughout September. The weather is always better when near Colombo.

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MONTHLY STATEMENT OF CURRENTS and WINDS on the COASTS of CEYLON—continued.

OCTOBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. No current		Moderate	S.W., N.E., N.W. to S.W. to N.E.	Moderate	In October the winds and currents are variable with cloudy unsettled weather, sometimes heavy squalls of wind and rain. The current generally sets with the wind when it is fresh. The sea is moderate, very hazy over the land.
Between Pambam and Jafna.	1 to 2	Tidal ebb northerly, and flood southerly. Tidal do.	Light		Smooth	In the first part southerly winds and fine weather prevail, in the latter part southerly winds prevail, bringing cloudy weather with occasional squalls of rain from the N.E. The sea also begins to get up in Palk straits off Karativa and the north coast off Kankesan-toral.
Between Jafna and point Pedro.	1 to 2		Moderate	S.S.W., N.E.	Moderate	The north coasts apply to the coast as far as Point Pedro. At the end of the month the weather is dull and cloudy with very hard squalls of wind and rain from the N.E. with a high sea.
Between point Pedro and Trincomali.	Slight to $2\frac{1}{2}$	S.S.E.	Fresh	W.S.W. to N.E.	Moderate	In the first part the winds are moderate from W.S.W. with fine but cloudy weather with moderate rain. In the latter part the weather begins to get unsettled and cloudy with thick squally rainy weather, the wind is mostly from S.W. and N.W. to north and N.E. with high N.E. sea, and the current strong to the S.E.
Between Trincomali and Batticaloa.	Slight to $1\frac{1}{2}$	S.S.E.	Fresh to light.	W.S.W. to S.E.	Smooth to moderate.	In the first part fresh W.S.W. winds prevail about Trincomali as far as Vandelu bay, and at Batticaloa bay land and sea breezes with fine weather, but in the latter part the wind and weather becomes very unsettled with cloudy, heavy squally weather, much lightning to the N.E. and east, very hazy over the land.
Between Batticaloa and Little Basses.	$\frac{1}{2}$ to 2	S.S.W.	Fresh to light.	S.W. to easterly.	Moderate	In the first part the land and sea breezes prevail about Batticaloa, but near the Little Basses fresh S.W. winds prevail in the afternoon and the current is weak, but at the end of the month it runs 2 knots to the S.S.W. and the weather begins to get unsettled and cloudy with squally weather. Sometimes heavy squally weather from the N.W.
Between Little Basses and Hambantotti.	Slight to 1	W.S.W.	Moderate	S.W. to N.W.	Moderate	Between Little Basses and Hambantotti land and sea breezes prevail with occasional squalls of wind and rain, but the weather is generally fine and clear. There is a very little current about the first part of the month, but it runs to the W.S.W. 1 knot at the end of the month.
Between Hambantotti and Galle.	No current		Moderate	S.W.	Moderate	First part moderate westerly winds and fine weather, hazy over the land. Later S.W. swell still continues.
Between Galle and Colombo.	No current		Moderate	W.S.W.	Moderate	In the first part the weather is fine and the wind from S.W. to N.W. and W.S.W. with hazy weather. In the latter part the weather is very unsettled, sometimes very heavy squalls of wind and rain from S.W. The heavy S.W. swell continues this month, the currents are light and variable.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.

NOVEMBER.

Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. $\frac{1}{4}$	Northerly	Moderate	N.W. to N.E.	Moderate	The winds and weather are very unsettled, the wind veering W.N.W. to north and N.E., with frequent heavy squalls and rain. Cloudy overcast sky.
Between Pambam and Jafna.	1 to 2	Tidal ebb northerly and flood southerly.	Moderate	Variable	Smooth	The winds and weather are very unsteady and unsettled with cloudy squally weather and frequent heavy falls of rain.
Between Jafna and point Pedro.	1	Tidal ebb to eastward and flood to westward.	Various	Variable	Smooth	The winds and weather are unsteady and unsettled with hard squalls of wind and rain, and when from N.E. the sea rises rapidly; the current out at sea setting to S.S.E. and the flood tide together causes a strong indraft towards Palk Bay.
Between point Pedro and Trincomali.	2½	S.S.E.	Fresh	N.E.	High	The same remarks apply to these places, but the wind is more frequent N.E., and sometimes a northerly gale sets in, with a high turbulent sea. The current is as much as 3½ knots at times. It is very cloudy and gloomy over the land.
Between Trincomali and Batticaloa.	2 to 3	S.S.E.	Moderate	N.E.	Moderate	The prevailing winds are from the N.E., but it frequently comes from west and S.W. It is squally with rain during the month and very hazy over the land.
Between Batticaloa and Little Basses.	1½ to 2½	S.S.W.	Light	N.E.	Moderate	The prevailing winds are from the N.E., but there are occasional southerly and westerly winds and cloudy weather. It is squally and rainy unsettled weather during this month.
Between Little Basses and Hambantotti.	1½	W.S.W.	Light	Westerly	Moderate	The prevailing winds are westerly, but it is very unsteady, and variable winds may be expected, also calms with occasional squalls and rain.
Between Hambantotti and Galle.	No current	No current	Moderate	Westerly	Moderate	The winds are variable, and the weather very unsettled, with frequent calms and squalls of wind and rain; it is very hazy at times over the land.
Between Galle and Colombo.	No current	No current	Light	N.E. to W.N.W.	Moderate	Light variable winds mostly from N.E., sometimes very heavy squalls of wind and rain from N.E. to north. The winds and weather is generally unsettled, the current sets slightly to the southward.

MONTHLY STATEMENT OF CURRENTS AND WINDS ON THE COASTS OF CEYLON—continued.
DECEMBER.

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Places.	Currents.		Winds.		State of the Sea.	REMARKS.
	Force.	Direction.	Force.	Direction.		
Between Colombo and Pambam.	Knots per Hour. ½ to 1	Southerly	Fresh	N.N.E. to E.N.E.	Moderate	Fresh N.E. and E.N.E. winds prevail; the weather in the first part is generally cloudy and hazy with a few squalls of wind and rain. In the latter part the winds are moderate and the weather much finer.
Between Pambam and Jafna.	Tidal 1½ to 2½	Tidal ebb northerly and flood southerly.	Fresh	North to N.E.	Smooth	The winds are fresh from north to N.E. with squalls and rain the first part of the month, becoming more moderate with finer weather in the latter part. The sea is smooth except the wind is against the tide.
Between Jafna and point Pedro.	Tidal 1½ to 2½	Tidal ebb east and flood west.	Moderate	North to E.N.E.	Moderate	The prevailing winds are from north to E.N.E. and blow fresh with squalls and rain in the early part of the month but in the latter part fresh breezes but much finer weather; during some days it is very cloudy.
Between point Pedro and Trincomali.	1 to 3	S.S.E.	Fresh	N.E.	High	The same winds and weather in the early part of the month, but more moderate in the latter part; the sea is high owing to the easterly swell. In very strong winds the sea is high and turbulent especially off Muletiu.
Between Trincomali and Batticaloa.	1 to 3	S.S.E.	Moderate	North to N.E.	Moderate	The prevailing winds are from north to N.E. and sometimes a gale occurs from north to N.W. with heavy rain and a very high turbulent sea. In the latter part it is much finer weather. The easterly swell is very bad at Batticaloa anchorage.
Between Batticaloa and Little Basses.	1 to 4	S.S.W.	Fresh	North to N.E.	High	The wind varies from north to north-east and E.N.E. and N.W.; it blows fresh at times in the early part of the month with hard squalls and rain with a high turbulent sea, but the winds and weather is much better towards the end of the month.
Between Little Basses and Hambantotti.	1 to 3	W.S.W.	Fresh	N.N.W. to East.	Moderate;	In the first part the winds are fresh, with cloudy weather with occasional squalls and rain. In the latter part is finer but very hazy at times. At Hambantotti the wind is N.E. in the morning and S.E. in the afternoon.
Between Hambantotti and Galle.	½ to 1	W.S.W.	Light	Easterly	Moderate	The prevailing winds are easterly light in the morning and fresh in the afternoon. Light showers of rain may be expected off Point de Galle with land and sea breezes.
Between Galle and Colombo.	½ to 1	S.S.E.	Light	N.N.W. to N.N.E.	Smooth	Land and sea breezes prevail also light variable winds and calms with light showers of rain at times. The weather in general is fine and clear with a smooth sea.

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